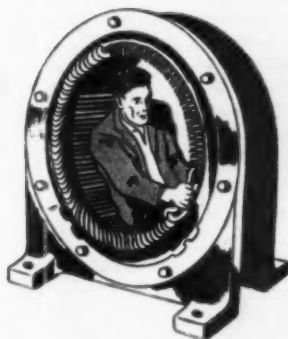


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APRIL • 1940

G-E Pyranol Transformers

Offer NEW SOLUTIONS

to Many Factory and Commercial Distribution Problems

PROBLEM 1 MODERNIZATION OF FACTORY LIGHTING

In one case, the engineers were asked to increase lighting levels on a factory floor to between 25 and 35 foot candles. The existing lighting circuit, which was 600 feet long, ran from a substation outside the building. To handle the increased lighting load with old methods would have required a new and larger transformer outside the building and new and larger secondary copper inside. Pyranol transformers provided a new solution to this problem that utilized the existing wiring and resulted in savings of 40 per cent.

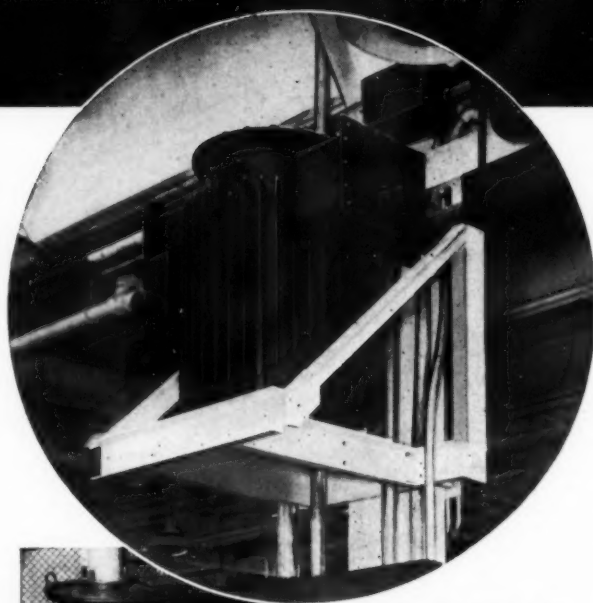
The old wiring was split into three sections, and a small Pyranol transformer was installed at the center of each section. The expense of running new secondary copper was avoided; voltage regulation was better and power losses lower than they would have been on the long circuit.

PROBLEM 2 AIR CONDITIONING IN OFFICE BUILDINGS

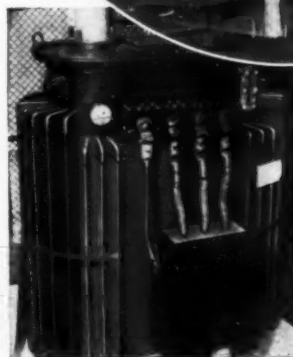
The installation of air-conditioning equipment in buildings frequently presents a problem in power distribution that can be answered economically by Pyranol transformers. The Pyranol transformer shown at the right is installed on the third floor of the Equitable Building in Des Moines, Iowa, to supply an air-conditioning load on that floor. Because Pyranol is noninflammable, the transformer could be installed without a vault, at a convenient location near the load center.

PROBLEM 3 POWER FOR CON- CENTRATED FACTORY LOAD

Welding machines in the Pittsfield Works of General Electric required power at 575 volts. Floor space was at a premium, and this fact made it impracticable to build a fireproof vault near the load center and install oil-filled transformers. Pyranol transformers—three of them, each rated 635 kva, 13,800 v—provided the answer and reduced the over-all costs of the installation. For your installations, it will pay you to investigate the possibility of savings with Pyranol transformers. Ask your G-E representative for complete information, or write for Bulletin GEA-2637. Address General Electric, Dept. 6C-201, Schenectady, N. Y.



Up near the ceiling, out of the way, is one of the Pyranol transformers that made possible savings of 40 per cent in the cost of modernizing a factory lighting circuit.

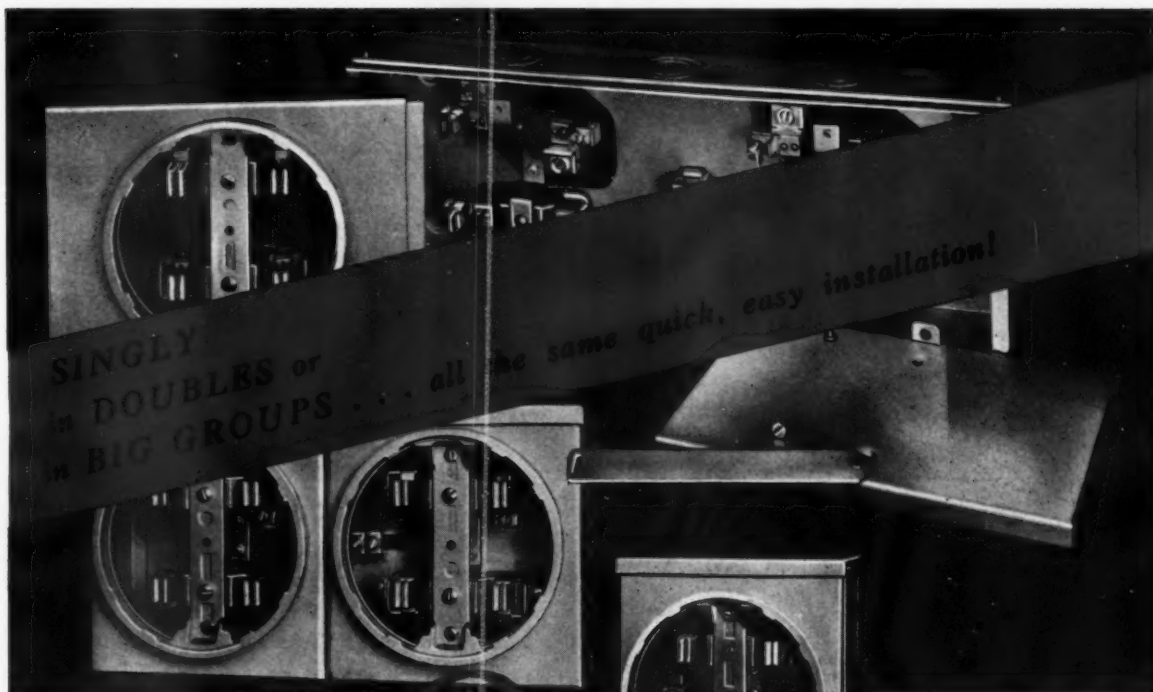


Greater safety, plus savings in the over-all cost of transformer installations, makes Pyranol transformers the most practical and economical transformers for office buildings, theatres, hospitals, and other public buildings.



GENERAL ELECTRIC

300-71



Murray

Troughs

for SOCKET-TYPE

meters

OF all types of socket meter troughs, none are easier to install than these Murrays. Everything FITS. There are knockouts aplenty. Murray solderless connectors make it *easy* to bring in and hold the service wires. Singly, in doubles or in groups of any size desired, these Murray unit-troughs are hung and connected in the same, simple, quick way. This is indeed the modern, economical method. Send the coupon for the facts. Metropolitan Device Corporation, Brooklyn, N. Y.

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FOR THE
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METROPOLITAN DEVICE CORP.
Brooklyn, N. Y.

Gentlemen: Please send me—free of cost or obligation—my copy of "MURRAY METER TROUGHS."

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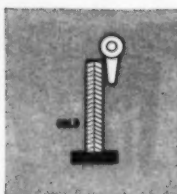
BI-METAL



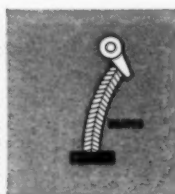
Ask Your Westinghouse Representative For This Bi-Metal Demonstration

Make This Test Yourself... A strip of Bi-Metal and a match are all you need to prove to yourself the time and money-saving advantages of Bi-Metal Protection. Ask your Westinghouse Representative for Bi-Metal Demonstration Kit.

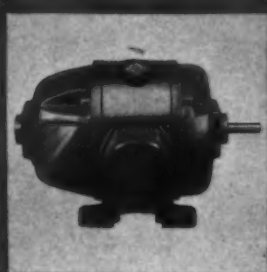
HERE'S HOW BI-METAL SAVES MONEY ... GIVES BETTER PROTECTION



Two different metals bonded together, when heated always bend in the same direction. The heat from short circuit or continued overload currents causes the Bi-Metal, which is exactly calibrated to the job at the factory, to act and open the circuit. Because of Bi-Metal's characteristics, its accuracy never changes, regardless of the number of operations. There's nothing to replace... nothing to wear out.

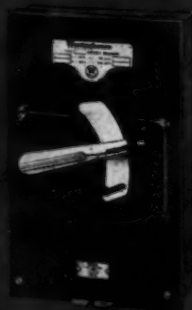


YOU PAY NO MORE FOR BI-METAL PROTECTION IN THIS WESTINGHOUSE EQUIPMENT



THERMOGUARD MOTOR

Single-phase runs up through 10 hp. Dependable to last and accurate Bi-Metal protection.



GENERAL CIRCUIT BREAKER

Bi-Metal eliminates fuses. "De-ice" and ground-fault protection. Operates with cabinet closed. Safety interlock.



LIGHTING AND POWER PANELS

Bi-Metal protects circuits. Eliminates fuses. "De-ice" and ground-fault protection.

Westinghouse



GIVES MOST ACCURATE PROTECTION

ORIGINAL CALIBRATION UNCHANGED BY REPEATED OPERATION OF THIS MANUAL STARTER

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The Bi-Metal relay is accurately calibrated at the factory. It maintains this accuracy unchanged even after repeated operation. Before the heat of an unsafe overload can damage motor windings, the Bi-Metal operates automatically to disconnect the motor from the line. There is nothing to renew or replace. You save time, trouble and money.

PLUS THESE MONEYSAVING FEATURES

Indicating handle shows clearly whether starter is "on," "off," or "tripped." Safety interlock prevents accidental contact with live parts. Double break silver contacts give quick-make, quick-break.

"DE-ION" ARC QUENCHERS AT NO EXTRA COST

Westinghouse "De-ion" arc quenchers confine, divide and extinguish the arc instantly ... prevents burning of contacts.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.



"DE-ION" MOTOR WATCHMAN

A manual motor starter for motors up to 7½ hp.

Motors and Control

You Ought to Know About Benjamin's LATEST FLOODLIGHT DEVELOPMENT

The New BENJAMIN-ALZO-LITE With New *Watertight* Cover!

Subjected to a fifty-pound pressure stream of water for 100 hours . . . and still no sign of leakage!

Bathed in a continuous bath of steam for 500 hours . . . and not a sign of seepage!

Such are the weather-proof, vapor-proof, dust-proof, and heat-resisting qualities of the new Benjamin Alzo-Lite 750-1500 watt Floodlight with its new water-tight cover.

This new cover provides a positive seal against breathing and seepage of moisture into the reflector and thus prevents bulb breakage caused by the condensation of such vapors. Moreover, this cover protects the reflector from dust and clouding, reducing the frequency of cleaning.

Servicing is simplified by a hinged cover and by a Positioning Stop Mechanism which permits tilting of the reflector upwards for cleaning from above and returns it to the same position

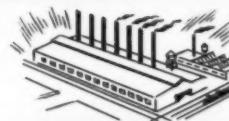
at which it was positioned and focused at the time of installation. The cover is hinged to the floodlight and held in place by hand-operated clasps. Thus there is no danger of droppage—no need for tools to open or close the cover.

With the new Benjamin Water-Tight Cover, the Alzo-Lite unit as described in Bulletin Number 4543 is especially desirable for floodlighting of football and baseball fields, playgrounds and other outdoor locations such as construction areas, yards, strip mines, etc. For further details and descriptive bulletin on the new Water-Tight Cover . . . Address the Benjamin Electric Mfg. Co., Des Plaines, Ill



YOU CAN DEPEND UPON BENJAMIN FLOODLIGHTS

To Embody Every Known Feature of Design and Construction That Contributes to Efficient, Longer-Lived, Economical Performance and Easier Servicing



The Benjamin Duo-Service Floodlight for Service Station Floodlighting

1. Two-in-One Floodlighting—porcelain enamel reflector floodlights grounds, inner reflector directs high intensity spotlight beam on station buildings.
2. Lifetime Efficiency—porcelain enamel reflector surface never wears out.
3. Rock-hard Surface—dirt or grime cannot penetrate or scratch porcelain enamel.
4. Easy To Clean—soap and water quickly restores porcelain enamel to original high lighting efficiency.
5. No Deterioration—reflector surface cannot decompose, disintegrate or oxidize.
6. Weatherproof—unaffected by smoke, rain, snow or other weather conditions.
7. Patented Saffox Feature—permits lowering reflector and cleaning from ground . . . faster, safer, easier.

The Benjamin Ellipto-Lite Floodlight for General Floodlighting

A wide angle open-type floodlight. Combines the unexcelled light diffusion properties of porcelain enamel reflecting surface for lighting a large area with an inner Alzak aluminum auxiliary reflector which furnishes a high intensity spotlight beam. The Ellipto-Lite is particularly suitable for floodlighting outdoors sports areas, playgrounds and parking lots. Unique hood construction permits removing reflector for easy cleaning on the ground without disturbing socket, wiring or position of bracket.



BENJAMIN ELECTRIC MFG. CO.
Des Plaines, Illinois

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Send Me Bulletins On Items Checked Above.

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The Benjamin Column-Lite for Lighting Pump Islands, Railway Platforms, Safety Islands, Parkways, Walks and Drives, Gardens and Courts.

Providing a widespread flood of glareless light, even at low mounting heights, the Benjamin Column-Lite is ideal for the lighting of

many locations, and especially pump islands and other service station areas. Glare is reduced to a minimum by a deep, overhanging reflector skirt which shields the filament from the eye. Column-Lite is not a substitute for floodlighting but provides supplementary lighting that further increases seeing speed . . . improves appearance of service stations . . . attracts an increased volume of night business.

BENJAMIN

TRADE MARK

LIGHTING EQUIPMENT

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A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

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IT GOT ME A \$2,600 ORDER. Received mine the other day and put it to work right off. Right now I'm taking this Anaconda Duracode up to the job to finish up. We used it all the way through and is that plant engineer pleased!

Better get busy with it yourself. I read where \$300,000,000 is going to be spent on industrial wiring this year and with Anaconda's survey I intend to get my share.



Without obligation send me a copy of Anaconda's new Wiring Survey.

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APRIL, 1940

Our Proud Whistle

YOU KNOW MARK TWAIN'S TALE of the old time Mississippi steam boat captain. He boasted the biggest whistle on the river. But every time he blew the whistle, it used up so much steam, it stopped the boat. It sounds silly to me.

BUT I WONDER IF THIS IS ANY SILLIER than the present practice of our manufacturers of electrical wiring materials and devices. They make so many excess and duplicating varieties, it has become a costly burden to them. It wastes money, too, for all those who distribute and install their lines and have to select and stock this stuff.

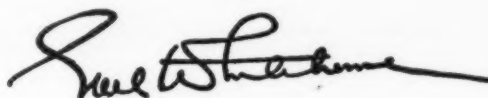
THE FULL LINE MANUFACTURER OF WIRE, for example, makes 64 varieties of every size of rubber covered wire from No. 14 to 2,000,000 c.m. That's 26 sizes—each made in solid and stranded copper, four grades of rubber, and eight standard colors—or, in all, 1664 different wires. But some say we could eliminate all except 75° rubber and throw out 75 percent of the varieties—not considering the new thin wall types. And the 75° grade would then cost a lot less than it does now.

THE MANUFACTURERS OF CONDUIT AND OUTLET BOXES, for example, still make black and white pipe in 15 sizes and a full set of duplicating boxes and covers—about 400 varieties in all. Yet they could make white pipe the standard with an enormous saving in production, warehousing and distribution for everybody. And when somebody wants black enamel for a corrosive atmosphere, put it on the white stock.

THE MANUFACTURERS OF SERVICE ENTRANCE EQUIPMENT make more than 1000 combinations. Probably 500 would be enough. Again the wiring device people still make rotary and push switches when toggles are newer and better. There are other good examples of old models dragged along. Yet walk into a Buick show room and ask for a nice new shiny 1935 model sedan. See what they say.

AND SO THE WHOLE INDUSTRY IS MUSCLE BOUND with this unnecessary junk that has accumulated like old furniture in an attic. I can't see any sense in making it or shipping it or installing it. And all this excess mess is eating up the proper profits of manufacturers, wholesalers and contractors. It's making wiring more costly.

THE SITUATION CAN BE LEGALLY CORRECTED, I'm told, by asking the Bureau of Simplified Practice in Washington to sponsor a general line reduction. They have helped with paving brick, china ware and God knows what. It all depends on whether we who make and warehouse and install this stuff are ready to quit admiring our whistle, ready to speed up the boat.



See your way to new profits via **FLUORESCENT** light

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Right now, buyers everywhere are highly receptive to the idea of lighting modernization using the new fluorescent lamps. Profitable equipment sales and installation contracts are waiting for the man who *knows the whole story* on fluorescents. For sales to stores, offices and industrial plants particularly, you'll need all the facts — all the "do's-and-don'ts," and an up-to-the-minute picture of the reflectors and accessories currently available.

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18-inch (15 watts); 24-inch (20 watts); 36-inch (30 watts); 48-inch (40 watts). In white, "daylight," and a wide range of colors for special purposes.

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OFFICES IN 82 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.



WIRING IDEAS From a Streamliner

Within the polished aluminum and stainless steel walls of a modern streamliner is a big job of electric wiring. In the design and installation of this wiring system are ideas that electrical men can use.

By W. T. Stuart

SIX years ago, the first "streamliner" rolled out of the shop to catch the public eye and imagination. At the first of this year, there were 73 high-speed, light-weight railroad trains of the streamliner classification rolling the rails on regular schedules.

Sleek streamliners brought new glamour to the railways. But the revolutionary improvement in train design which they represent goes deeper than the modern coat of stainless steel or aluminum. Less spectacular but equally important are the changes wrought in interior design; lighting, air conditioning, and the many ubiquitous services that modern engineering has taught the public to expect.

Just as new electrical equipment has increased the utilization of electricity in homes and offices, so the luxuries of modern travel have demanded carefully designed and adequate wiring systems. And out of this new technique that has evolved have come ideas that electrical contractors can use in other work.

Train electrical systems can be divided roughly into two classes. One is the isolated car system in which a generator, coupled to the wheels, and a battery provides the source of electrical energy for each car. This is the system commonly used on the conventional

train. Methods of inter-connecting cars are provided but, as a rule, each car has its individual isolated 32-volt direct current plant and wiring system.

The new method, which came in with the streamlined train, is not a car wiring but a train wiring system. In a head-end plant, usually diesel driven generators in a power car, provide alternating current at standard commercial voltages to a feeder system running the full length of the train.

Union Pacific's "City of Los Angeles", a 17 car train consisting of three power units built by Electro Motive Co. and 14 trailing cars built in the shops of the Pullman Standard Car Manufacturing Co., has one of the latest designs in electrical distribution systems for streamlined trains. It is equipped as follows—

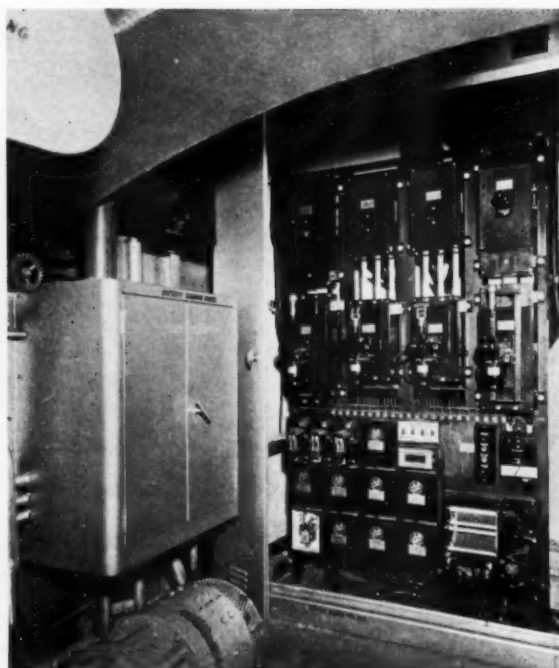
In the forward power car are two 300-kva. diesel driven electric generators providing 220 volt, three-phase, ungrounded, delta current to the train switchboard. The distribution system is a set of 4 feeders, known as train lines, which extend through the train from which sub feeders connect to the distribution cabinet in each car.

The power system has two train lines. Each consists of six 350,000 circular mil cables, with two cables paralleled for each phase. For lighting there are two 3-phase train lines consisting of 3/0 conductors.

Additional train lines carry two battery circuits, one consisting of two 4/0 cables for a 64-volt d.c. control circuit and one line consisting of 2/0 cables for a 32-volt direct current emergency lighting circuit. Two additional train-



HEAD-END generating equipment in the auxiliary power car. Two 450 hp. diesels drive 300-kw. 3-phase, 220-volt generators; enough electric power for a 1,000 room hotel or 15 story office building. Compact installation allows ample room for maintenance.



MAIN SWITCHBOARD. Upper breakers control 4 light and power train lines. Center motor-operated breakers connect train to stand-by receptacle for external power supply. M-G set and cabinet at left charge the batteries for control, signal and marker lights.

lines consist of 16 conductors each for air signals, air brakes, crew telephones, passenger telephone, porter signals, mail signals, radio and loud speaker, and trainline control.

Circuit continuity between cars is provided through large plug receptacles with loops of extremely flexible rubber insulated welding cable. With head-end plants and heavy feeder currents, a safety device is included in the plug receptacle to prevent separation of the main contacts under load.

A chain, shorter than any of the cables connects the plugs between cars. The receptacles include contacts for a control circuit designed to open before the main contacts separate. Through a control circuit the control line operates a high speed circuit breaker in the power car which disconnects the feeder before the receptacle separates.

An electric locker at the forward end of each car houses contactors, switches, lighting panelboard and protective equipment. From the feeder receptacles the main feeder circuits are carried in a trough under the floor of the car to the receptacle at the opposite end. At a junction box below the electric cabinet are taps for the car circuits. Each car is then tapped off the duplicate

power and light feeders alternately.

The power load in each car consists of two 10 hp. air conditioning compressors, exhaust fans, and electric heaters in the ceiling operated by remote control contactors and an automatic heat control panel.

Summer air conditioning is provided by the two compressor motors. A unique control feature starts air conditioning compressors in a definite sequence. When the car temperature rises and the thermostat operates to start the compressors, the controller cannot operate until the starting circuit is closed through a 14 point motor driven sequence switch timed to allow each motor to reach full speed before the next circuit is closed. Thus the power load will not exceed the full running load plus the starting current of one air conditioning unit.

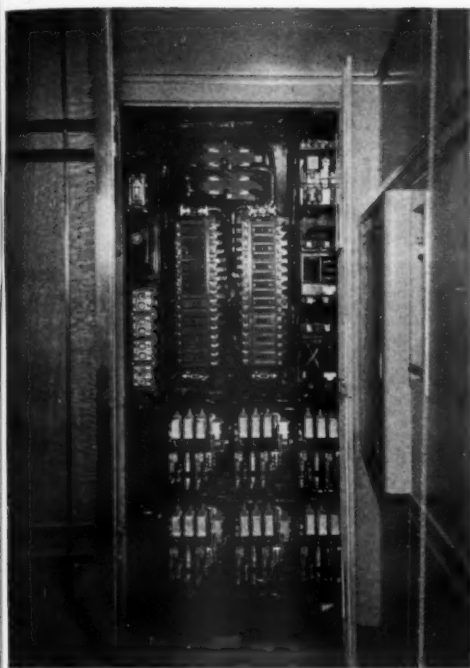
Heating is provided by steam coils automatically valved by thermostatically controlled, electrically operated valves. Supplementing this are overhead electric heating units in the air conditioning ducts. The great advantage of electrical heating is gained at low temperatures when it is difficult to send steam through a train sometimes a quarter of a mile in length. In extreme weather

the losses in the piping system increase enormously with the length of the train and the car speed. However, the losses in the electric distribution system, unaffected by the weather, are negligible. The electrical facilities, generating capacity and feeder capacity, needed for summer air conditioning are already available.

The heating system is controlled by magnetic contactors operated automatically by thermostats. Control circuits for all equipment are fed by a 64-volt direct current train line.

Lighting circuits are a concession to traditional railroad standardization. Lamps are 32-volt and the energy provided by two 220/32 volt transformers of 1.5-kw. capacity each. Emergency or stand-by switches can connect a portion of the lighting system in each car to a 32-volt train line, which may be interconnected between cars to tap power from adjoining cars, an external stand-by source, or batteries in the power car or observation car. Marker lights, back-up lights and horn are operated from the 64-volt d.c. train line.

A separate 1-kw. 220/110 volt transformer feeds plug receptacles and part of the lighting load if lumiline or fluorescent lamps are used.



ELECTRIC LOCKER houses control and switching equipment. Circuit breakers control light and power circuits, fuse cutouts protect 64 volt control circuits, magnetic contactors operate air conditioning and heating equipment.

Lighting systems consist of indirect cove lighting or similar modern general lighting treatment in each car. Over each seat in coaches or compartments is a separately switched flush type lighting unit provided with a concentrating lens. Most trains are designed for 10 foot candles of general lighting. However, some very recent jobs are designed for 20 foot candles in dining and observation cars.

Wiring system design follows the rules of the National Electrical Code as a minimum. Branch circuit loads are carefully calculated and distributed to permit no more than 3 per cent voltage loss. This is particularly important on the 32-volt lighting circuits.

Circuits employed in both power and light wiring are fully insulated, ungrounded, with over-current protection in all conductors. Exposed circuits beneath the car are carried in rigid conduit, runs concealed in the floor structure in steel electrical metallic tubing and runs concealed in the walls or ceilings in aluminum electrical metallic tubing. Threadless fittings of equivalent materials are used for elbows, junctions, pull-boxes, and outlet boxes. Many special fittings, of malleable iron or lighter weight materials are designed especially for railroad work.

Conductors are heat resistant grade 30 per cent rubber covered wire. Some runs, which must be located near steam pipes, have short sections of asbestos insulated conductors or other heat resistant insulation. Flexible cords to stand-by receptacles are tough flexible rubber covered cables.

Limited wiring space requires careful coordination with other structural features of the car. Conduit and E.M.T. runs are prebent and cut from large scale drawings and carefully fitted into place. Conduits are clamped at every point where they touch a structural member.

Solderless wire lugs and connectors are now standard material on most of the new trains. Transformers are insulating type, air-cooled, mounted in electric lockers in each car. Over-current protection on branch circuits in the lighting system is provided by double pole circuit breakers. Overload protective devices in the controlling contactors provide protection to the power circuits. Separate overload protection is provided for the 64-volt direct current pilot and control circuits.

The electrical engineers, designing train wiring, are faced with several problems that are often met by electrical contractors and maintenance men in industrial and commercial work.

1. Safety is of paramount importance. American railroads have set a phenomenal record of safety unapproached by any other means of transportation. A good share of the credit for this belongs to the train designer. Electrical systems are metal enclosed and fully insulated. No part of the 220-volt system or equipment is exposed to passengers or car crews or run in the same conduit with 32-volt wiring. All control devices operate from a separate 64-volt circuit. Seat lights or other electrical equipment which the passenger is likely to contact operates on 32-volts.

2. Vibration is an ever present problem. It may be damped for the comfort of the passenger, but even though it is insensible to them it is there and the wiring system must be able to withstand its effects. In train building this is accomplished by tight clamping at close intervals and secure terminal fittings.

3. Wiring systems must be installed

in a restricted space. Careful planning, detailed drawings and coordination with structural design make it possible to fit a remarkable amount of electrical wiring equipment into the restricted space available. This has been successfully accomplished with standard materials, to an expense that the ordinary contractor or plant electrician would consider impossible.

4. Weight distribution is important. Stability and passenger comfort in light weight cars require a low center of gravity. Designers keep heavy equipment and wiring at or under the floor level and use light weight materials in the overhead wiring.

5. Attractive modern trim of car interiors is augmented by inbuilt coves and flush lighting equipment. General lighting is provided by concealed indirect sources. Supplementary lighting is under the control of the passenger.

6. Electric heating equipment operates from the same lines used for summer air conditioning and supplements steam heating system during severe weather.

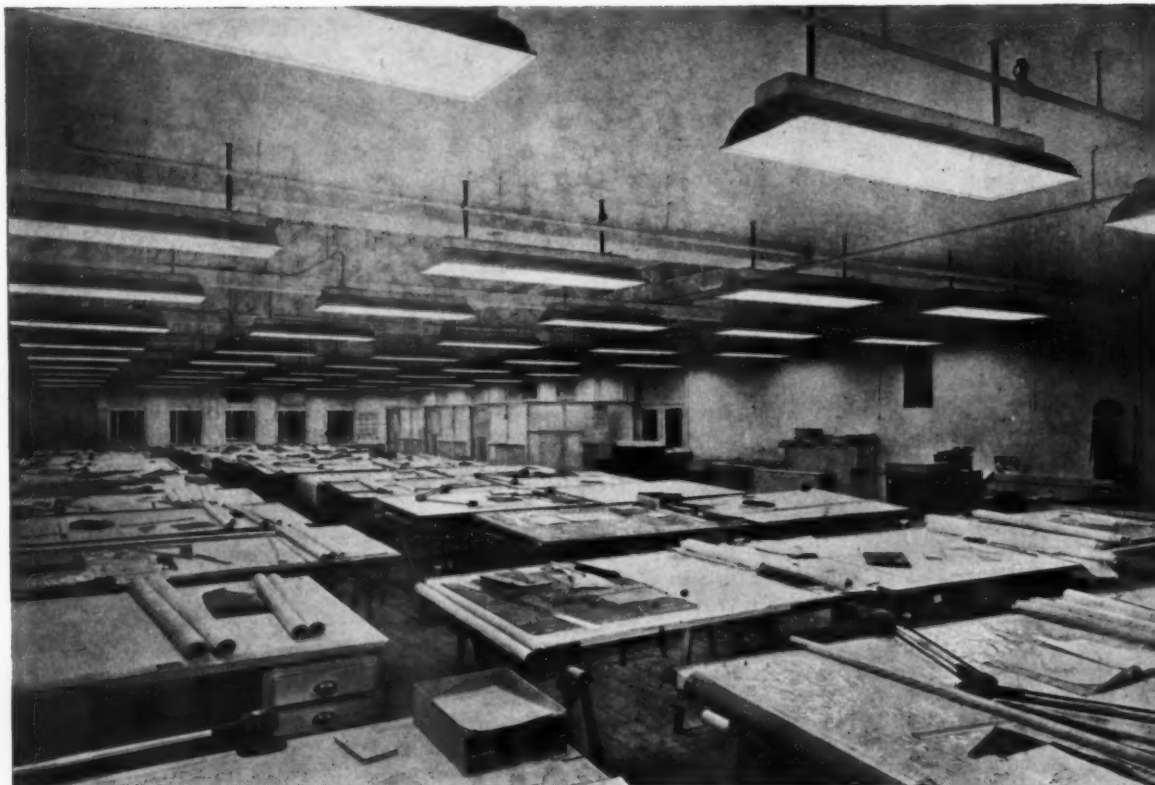
Train design engineers are in close touch with new developments in wiring materials and quick to adopt the best. But new or old, materials and methods must satisfy the traditional rule of railroading—Safety First.

Photos courtesy of Pullman Standard Car Manufacturing Co. and Union Pacific Railroad.



CONCEALED INDIRECT lighting, fixed table lamps augment the fine appointments of the observation car. Behind the scenes are powerful compressors for summer cooling, electric heaters for winter comfort, handled by the thermostat at the left.

FLUORESCENT INSTALLATION DESIGN



HIGH QUALITY general illumination is provided in this drafting room by 52 two lamp Benjamin Stream-Liters each equipped with two 40-watt daylight fluorescent lamps.

The design of a fluorescent lighting installation is not as difficult as it seems. For, with a few new tables and the basic formulae of incandescent design, calculations can easily be made by those familiar with general illumination principles.

FLUORESCENT lighting system design, although using an entirely new light source, embodies essentially the same general principles that apply to incandescent lamp lighting. Except for a new Coefficient of Utilization Table for fluorescent luminaires, the same set of tables used in incandescent lighting design can be used for fluorescent calculations. These include the familiar Room Index and Reflection Factor tables and of course the new Coefficient of Utilization table, shown on the opposite page.

From the standpoint of installation design, the new fluorescent lamps and reflectors have two unique characteristics which, at the present stage of



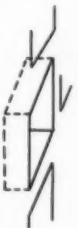



development must be considered in determining light intensities and layout dimensions. These are: 1. Torodial (doughnut shaped) light distribution instead of the well known spherical type of the filament lamp. 2. The lumen output and wattage of the new lamps are a function of the length of the lamp. More light means either an increase in lamp length or a larger number of lamps.

In incandescent lighting design it is a common practice first to prepare a layout, then calculate the size of lamp needed for the desired intensity. In fluorescent lighting calculations this procedure is usually reversed. The fixtures are selected, calculations made to

ROOM INDEX (Table 1) gives a classification based on the size and proportion of the room. The letter is keyed to the "Coefficient of Utilization" table.

For Direct and Semi-Direct Lighting		MOUNTING HEIGHT ABOVE FLOOR—FEET									
		7 and 7½	8 and 8½	9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 19			
Room Width (Feet)	Room Length (Feet)	ROOM INDEX									
9 (8½-9)	8-10	H	I	I	J	J	J	J	J	J	J
	10-14	H	H	H	I	J	J	J	J	J	J
	14-20	G	G	H	I	J	J	J	J	J	J
	20-30	G	F	G	H	I	J	J	J	J	J
	30-42	F	F	G	H	I	J	J	J	J	J
10 (9½-10½)	42-up	E	F	F	G	H	I	J	J	J	J
	8-14	G	H	I	I	J	J	J	J	J	J
	14-20	G	H	I	I	J	J	J	J	J	J
	20-30	G	H	I	I	J	J	J	J	J	J
	30-42	F	F	G	H	I	J	J	J	J	J
12 (11-12½)	42-60	E	F	F	G	H	I	J	J	J	J
	60-up	E	F	F	G	H	I	J	J	J	J
	10-14	G	H	I	I	J	J	J	J	J	J
	14-20	G	H	I	I	J	J	J	J	J	J
	20-30	G	H	I	I	J	J	J	J	J	J
14 (13-15½)	30-42	F	F	G	H	I	J	J	J	J	J
	42-60	E	F	F	G	H	I	J	J	J	J
	60-90	D	E	E	F	G	H	I	J	J	J
	90-up	D	E	E	F	G	H	I	J	J	J
	14-20	G	H	I	I	J	J	J	J	J	J
17 (16-18½)	20-30	E	F	F	G	H	I	J	J	J	J
	30-42	E	F	F	G	H	I	J	J	J	J
	42-60	D	E	E	F	G	H	I	J	J	J
	60-90	D	E	E	F	G	H	I	J	J	J
	110-up	D	E	E	F	G	H	I	J	J	J
20 (19-21½)	20-30	D	E	F	F	G	H	I	J	J	J
	30-42	D	E	F	F	G	H	I	J	J	J
	42-60	D	E	F	F	G	H	I	J	J	J
	60-90	D	E	F	F	G	H	I	J	J	J
	140-up	D	E	F	F	G	H	I	J	J	J
24 (22-26)	20-30	C	D	D	E	E	F	F	G	G	H
	30-42	C	D	D	E	E	F	F	G	G	H
	42-60	C	D	D	E	E	F	F	G	G	H
	60-90	C	D	D	E	E	F	F	G	G	H
	140-up	C	D	D	E	E	F	F	G	G	H
30 (27-33)	20-30	C	D	D	E	E	F	F	G	H	H
	30-42	C	D	D	E	E	F	F	G	H	H
	42-60	C	D	D	E	E	F	F	G	H	H
	60-90	C	D	D	E	E	F	F	G	H	H
	140-up	C	D	D	E	E	F	F	G	H	H
36 (34-39)	20-30	B	C	C	C	D	D	E	E	F	F
	30-42	B	C	C	C	D	D	E	E	F	F
	42-60	B	C	C	C	D	D	E	E	F	F
	60-90	B	C	C	C	D	D	E	E	F	F
	140-up	B	C	C	C	D	D	E	E	F	F
42 (40-45)	20-30	A	B	B	B	C	C	D	D	E	E
	30-42	A	B	B	B	C	C	D	D	E	E
	42-60	A	B	B	B	C	C	D	D	E	E
	60-90	A	B	B	B	C	C	D	D	E	E
	140-up	A	B	B	B	C	C	D	D	E	E
50 (46-53)	20-30	A	A	A	A	B	B	C	C	D	D
	30-42	A	A	A	A	B	B	C	C	D	D
	42-60	A	A	A	A	B	B	C	C	D	D
	60-90	A	A	A	A	B	B	C	C	D	D
	140-up	A	A	A	A	B	B	C	C	D	D
60 (56-67)	20-30	A	A	A	A	B	B	C	C	D	D
	30-42	A	A	A	A	B	B	C	C	D	D
	42-60	A	A	A	A	B	B	C	C	D	D
	60-90	A	A	A	A	B	B	C	C	D	D
	140-up	A	A	A	A	B	B	C	C	D	D
75 (68-90)	20-30	A	A	A	A	A	A	B	B	C	C
	30-42	A	A	A	A	A	A	B	B	C	C
	42-60	A	A	A	A	A	A	B	B	C	C
	60-90	A	A	A	A	A	A	B	B	C	C
	140-up	A	A	A	A	A	A	B	B	C	C

COEFFICIENT OF UTILIZATION (Table 2) for fluorescent units gives the proportion of the generated light which reaches the working plane. It is found under the reflection factor for column and opposite room index for a specific type of unit.

Forms of Equipment With Typical Distri- butions and Efficien- cies.	Ceil- ing	75%			50%			30%			
		50%			50%			50%			
		Walls	50%	30%	10%	50%	50%	30%	10%	30%	10%
Room Index		COEFFICIENTS OF UTILIZATION									
 <p>RLM Luminaire</p>  <p>Downward - 78%</p>	J	.37	.31	.27	.35	.31	.27	.31	.27	.27	
	I	.45	.40	.38	.45	.40	.37	.40	.37	.37	
	H	.50	.46	.43	.48	.45	.43	.45	.43	.43	
	G	.55	.50	.46	.52	.48	.46	.47	.46	.46	
	F	.57	.53	.50	.54	.51	.50	.51	.50	.50	
	E	.61	.58	.54	.60	.57	.54	.56	.54	.54	
	D	.65	.63	.59	.64	.61	.59	.60	.59	.59	
	C	.67	.65	.61	.65	.63	.61	.63	.60	.60	
	B	.71	.67	.65	.66	.66	.65	.65	.64	.64	
	A	.72	.70	.67	.70	.67	.66	.67	.65	.65	
 <p>White Coffer</p>  <p>Downward 70%</p>	J	.37	.34	.32	.36	.34	.32	.34	.32	.31	
	I	.45	.42	.40	.44	.41	.40	.41	.40	.39	
	H	.48	.47	.45	.48	.46	.44	.46	.44	.44	
	G	.52	.50	.48	.51	.49	.48	.48	.48	.48	
	F	.55	.53	.50	.52	.51	.49	.51	.49	.49	
	E	.58	.56	.54	.57	.55	.53	.54	.53	.53	
	D	.62	.59	.57	.60	.58	.57	.57	.56	.56	
	C	.65	.61	.58	.62	.60	.58	.59	.58	.58	
	B	.64	.62	.62	.62	.61	.60	.61	.60	.60	
	A	.66	.65	.62	.64	.62	.61	.62	.61	.61	
 <p>Direct-Indirect Opal Glass</p>  <p>Direct-Indirect Opal Glass</p>	J	.23	.20	.18	.19	.17	.16	.16	.16	.14	
	I	.27	.25	.23	.23	.21	.20	.19	.18	.18	
	H	.30	.28	.26	.26	.24	.23	.21	.20	.20	
	G	.34	.31	.29	.29	.26	.25	.23	.22	.22	
	F	.36	.33	.31	.30	.28	.27	.24	.23	.23	
	E	.39	.37	.34	.33	.31	.29	.26	.25	.25	
	D	.42	.39	.37	.35	.33	.31	.27	.27	.27	
	C	.44	.41	.39	.36	.34	.33	.28	.28	.28	
	B	.47	.44	.42	.38	.36	.35	.30	.29	.29	
	A	.48	.46	.44	.39	.37	.36	.31	.30	.30	

TYPICAL EXAMPLE

Specification Details	Data From Tables
Type of room..... Sorting room.	Room Index—"G". (From Room Index Table 1.)
Dimensions of room.... 10' x 25' x 9 1/2'.	Maintenance Factor —M.F..... .70 (Average value.)
Interior finishes..... Ceiling, white Walls, light green.	Reflection Factors.. 75% for ceiling, 50% for walls. (From Reflection Factor Table 3.)
Fixture mounting height. Eight feet.	Coefficient of Utilization—C.U..... .53 (From Coefficient of Utilization Table 2.)
Type of lighting fixture. RLM fluorescent two lamp unit with two 40-watt white lamps.	Lumen Output of Lamp..... 4000 Lumens for two 40-watt white fluorescent lamps. (From manufacturer's data.)
Desired light intensity.. 60 foot candles.	

Calculations

To determine Total Lamp Lumens:

Substitute the data from the tables in the following formula:

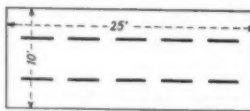
$$\text{Total Lamp Lumens} = \frac{\text{Foot Candles} \times \text{Area}}{\text{C.U.} \times \text{M.F.}} = \frac{60 \times 10 \times 25}{.53 \times .70} = 40,400 \text{ (Slide rule result.)}$$

To determine the Number of Units Required:

Substitute the above figure and the data from the lamp manufacturer in the following formula.

$$\text{Number of Units Required} = \frac{\text{Total Lamp Lumens}}{\text{Lamp Lumens per Outlet}} = \frac{40,400}{4000} = 10 \text{ Units.}$$

Plan View of Room
Showing Position of Units.



find the number of units needed to provide the design intensity and the layout adapted to the number of units required.

For calculating general lighting for fluorescent lamps and luminaires, the so-called "Coefficient of Utilization" method gives sufficiently accurate results for most jobs. The general formula is—

$$\text{Total lamp lumens} = \frac{\text{foot candles} \times \text{area}}{\text{C.U.} \times \text{M.F.}}$$

Where C.U. is the coefficient of utilization derived from the accompanying tables; M.F. is the maintenance factor, usually .70 for average conditions.

The first step in finding the value of C.U. is to determine the "room index" from Table 1. Here, for direct lighting in a room 10-feet wide, 25-feet long and with a mounting height of 8-feet, the room index is denoted as "G".

Next the "reflection factors" must be considered. Each different color has its own reflection factor, that is, it reflects a certain percentage of the light that strikes it. From the Reflection Factor Table, as an example, the value for white ceilings is found to be 75 per cent and for light green walls 50 per cent.

Now, knowing the room index and

reflection factor, the value of C.U. can be easily found in the RLM Luminaire section of Table 2. In this table reflection factors (shown at the top of the table) of 75 per cent for ceilings and 50 per cent for walls indicates the first column of the RLM table. Reading down this column to room index

"G" gives .53 as the value of C.U.

Knowing the above values of C.U., M.F., the area of the room and the foot candles required, it is a simple matter of substitution in the above formula to determine the total lamp lumens. Slide rule results are sufficiently accurate for this calculation.

After the total lamp lumens have been calculated, the next step is to find out how many fixtures are required to produce these lumens. The following formula is used—

$$\text{Number of units required} = \frac{\text{total lamp lumens}}{\text{lamp lumens per unit}}$$

From manufacturer's data on lumen output per lamp, the total lumen output per fixture of one or two daylight or white fluorescent lamps can be determined. Using this value and the calculated total lamp lumens in the above formula, the number of units required can be figured.

The next step is to layout the position of the units on the floor plan of the room. The layout problem in fluorescent lighting is more critical than that of incandescent units because of the unusual distribution characteristics of linear sources. Continuous rows of fluorescent units, end to end, are usually recommended for even light distribution. In general this type of spacing should be as close as possible, as the illumination value drops off rapidly beyond the end of the lamp. The equidistant or "square" layout of incandescent units has become a standard outlet arrangement and it is likely that equidistant rows of units mounted end to end will become the standard for fluorescent lighting.

REFLECTION FACTOR (Table 3) gives the percentage of light which a colored surface will reflect. These units are used in determining the Coefficient of Utilization of specific types of fixtures.

Color of Finish	Reflection Factor	Color of Finish	Reflection Factor
Pure White.....	85%	Light Tan.....	48%
Grey White.....	75%	Light Green.....	50%
Light Grey.....	61%	Med. Green.....	35%
Med. Grey.....	49%	Dark Green.....	7%
Dark Grey.....	30%	Dark Red.....	14%
Light Blue.....	48%	Chocolate Brown.....	9%
Med. Blue.....	21%	Wood Finishes.....	
Dark Blue.....	7%	Curly Maple.....	52%
Light Peach.....	65%	Prima Vera.....	50%
Peach.....	52%	Satin Wood.....	34%
Warm Cream.....	76%	Qt. Oak.....	33%
Light Cream.....	74%	Lace Wood.....	27%
Yellow.....	53%	English Oak.....	17%
Aluminum.....	57%	Walnut.....	16%
		Oriental Wood.....	14%

What NISA is Doing . . .

A short appraisal of what the National Industrial Service Association, Inc., is doing to help the motor shop man.

MOTOR shop men throughout the country are gathering together their problems and packing them in their gunny sacks for the annual trek to the National Industrial Service Association Convention, to be held this year at Detroit, April 22-24.

Here among the drones of this busy industrial city the M.D.'s of the motor world will sit down and discuss the problems of this important service branch of the electrical industry. They will try to make an honest appraisal of their own shops to find out what progress can be made in their field of endeavor, and to go back home with ideas that will yield more business and more profits.

Supplementing the convention, which is open to all shop men, NISA offers a number of services to its members, to guide them in building up an efficient profitable organization. Some of them are—

1. An annual survey, covering the entire country, provides the shop man with a comprehensive study of motor rewind and repair prices.
2. Studies and suggested methods of reducing operating and overhead expenses are given to members to pave the way for profitable operation in the face of keen competition.
3. The organization provides actual shop layouts, cost data on the minimum equipment and capital necessary to expand a shop to profitably handle small or large rewind jobs.
4. Exchange of methods, ideas and special equipment are accomplished through the medium of the NISA News pamphlet.
5. Technical and design information covering phase and speed changes in various motors is provided by the NISA technical committee.
6. Bulletins on federal regulations affecting small business establishments

and general business conditions are issued. Legal advice is offered when requested.

7. A Certification Committee is now making extensive studies to set up adequate standards that will ultimately be used as a basis for certifying motor shops. This will label a shop as having adequate equipment and a high standard of workmanship.

The convention this year in addition

to talks by industry leaders on the various phases of motor shop operation, equipment and service will devote an entire afternoon to a symposium on advertising and selling. The product exhibit this year is expected to be twice the size of last year's. It will cover the latest developments in shop equipment, wire, insulating materials, motors, controls and other items of vital interest to the repair shop man.



GALLOWAY

CONVENTION PROGRAM

APRIL 22—MONDAY MORNING

- "The Service Shop's Place in the Industry"
W. W. Hanks, Southern Electric Service Co.,
Charlotte, N. C.
- "Development of the Certification Plan"
F. W. Willey, Willey-Ray Electric Co., Cin-
cinnati, Ohio

MONDAY AFTERNOON

- "What a Manufacturer Expects of a Service Shop"
Fred. A. Wright, Cutler-Hammer Mfg. Co.,
Milwaukee, Wis.
- "What a Service Shop Expects of a Manufacturer"
A. C. Kater, Houston Armature Works,
Houston, Texas
- "Savings Affected by Shop Modernization"
P. M. Potter, Potter Rayfield, Inc., Atlanta,
Ga.
- "Foremen's Views of Modernization Plans"
A. H. Wolf, Swanson-Nunn Electric Co.,
Evansville, Ind.
- C. H. Scheidt, Roland Electric Co., Balti-
more, Md.
- "Carbon Brushes"
W. J. Siebenmorgen, Electric Service Co.,
Union City, N. J.
- "New Tools for Service Shops"
P. M. Potter, Potter-Rayfield, Inc., Atlanta,
Ga.
- H. E. Holub, Ideal Commutator Dresser
Co., Sycamore, Ill.

MONDAY EVENING

- Joint Dinner Meeting With Industrial Engi-
neer's Society of Detroit
- Inspection of Product Exhibit

APRIL 23—TUESDAY MORNING

- Business Meeting
- Election of Officers
- Committee Reports
- "Annual Summary of Rewinding Prices"
Wm. Braunlich, Braunlich-Roesse Co., Pitts-
burgh, Pa.
- "Survey of Overhead Expense"
S. F. High, G. W. Sullivan Electric Co.,
Cincinnati, Ohio

TUESDAY AFTERNOON

- Sight Seeing Tour of Greenfield Village
- Inspection Tour of Industrial Plants

TUESDAY EVENING

- Annual Banquet
- Speaker—Malcolm Binyay, Detroit Free Press

APRIL 24—WEDNESDAY MORNING

- "Key to Efficient Shop Operation"
E. C. W. Johnson, past president of NISA
- "Repairing Fractional Horse Power Motors"
F. M. Mielke, Mielke Electric Works, Duluth,
Minn.
- H. E. Grant, Tennessee Electric Motor Serv-
ice, Nashville, Tenn.

WEDNESDAY AFTERNOON

- Symposium on Motor Shop Advertising and
Selling
- Led by R. M. Koontz, Koontz-Wagner Elec-
tric Co., South Bend, Ind.
- Topics: "Does Advertising Pay?"
- "Selling Efficient Electric Service"
- Round table Discussion of Shop Experiences

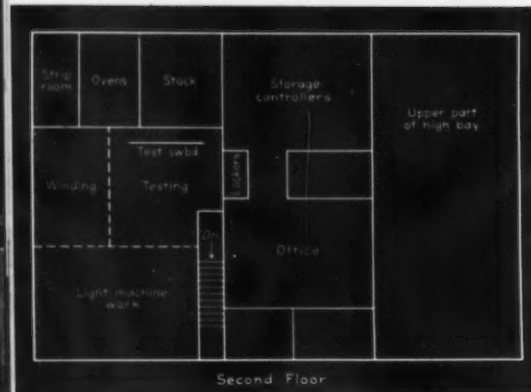
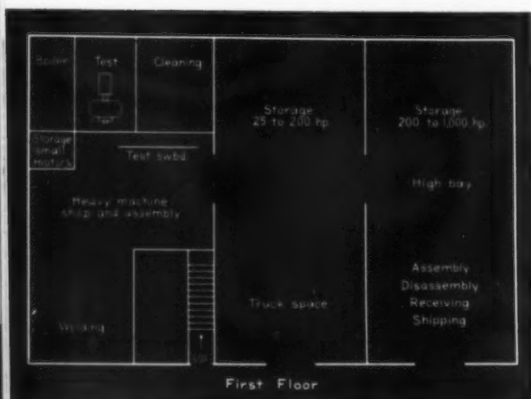
Organized for Large



HEAVY MACHINE shop on the lower floor. All machinery is individually driven. Test and cleaning departments are at the rear. Behind lathe in right foreground is an armature undercutter.



LARGE OFFICE houses sales, engineering and clerical staff. Chicago Electric has an aggressive sales policy, advertises extensively and employs a staff of competent sales engineers.



THE Chicago Electric Company, founded back in 1915 by Charles Kaska, president and George Claus- ing, secretary-treasurer, is located in Chicago's industrial South Side. During the ensuing years they gathered about them a staff of competent engineers, mechanics and salesmen. Their market spread out over the Middlewest.

In 1931 they built their present plant which covers about 50,000 sq. ft. in two stories. Brick and mill construction has been reinforced with heavy steel beams and columns. Thirteen cranes completely cover the shop area. A high bay brick and steel addition with a 30 ton capacity crane is equipped to handle anything that can be wheeled through the doors. In planning the shop they looked ahead toward handling the big-

ger units of both the standard and specially designed types of equipment which are used for the heavier industrial requirements in the vast fields of steel and other basic industries. The ground floor was designed to handle heavy loads. Big doors allow trucks to drive into the building and an overhead crane lifts incoming jobs directly off the truck. In 1938 a two story high bay addition was built with a 30 ton crane for still bigger equipment.

Mechanically efficient handling of heavy equipment depends on facilities for lifting and moving, shop machinery adaptable for heavy machine work and adequate testing facilities.

In this shop all working areas are covered by cranes and hoists of ample capacity, there are no hand lifting jobs.

On the ground floor is the heavy machine shop, cleaning department and testing equipment. This shop handles all mechanical work on the units over 50 hp.

Coils are wound in a separate depart-

LAYOUT DIAGRAM of shop. Heavy work remains on ground level, light motors, switchboards and repair work are routed through second floor shop.

Electrical Contracting, April 1940

Motor Repairs

Chicago Electric Company, motor rebuilders and industrial engineers, set out to handle units of 100 hp. and up with the same precision and facility of a 1 hp. rewind job. For the past ten years they have progressively modernized shop and machinery for each operation. Today they rate tops in facilities for handling large equipment.



CONFERENCE OF engineering and sales department. Left to right William E. Anderson, power transmission division; Harry F. Turner, sales engineer; Joseph James, sales engineer; Theo. Herman, shop foreman; Paul Kessling, master mechanic; Charles B. Kaska, president; Stanley Vesely, chief electrical engineer; George W. Clausung, secretary and treasurer; Glenn F. Glave, sales engineer; and Robert C. Kaska, general superintendent.

REPAIRING UNITS of several hundred horsepower is all in the day's work for this modern shop. Size of the jobs can be judged by comparing with the men at the left. Feeder under crane rail at left rear carries test lead extensions from the testing department.

ment on the floor above. When work is received, complete name plate data is taken and checked with manufacturers data. Accurate drawings are made and the disassembled machine dispatched to mechanical and winding departments.

The second floor shop also includes lathes, drills, and bench equipment for small motors, and switchboard work. Separate test equipment is located on the second floor shop for tests within the capacity of the regular electric service.

One of the major problems facing a shop specializing in big stuff is ade-

quate testing facilities. Central station power is out of reach because of demand charges. Chicago Electric solved this with a local testing plant. A gas engine generator set provides 250 kva. initial power to a unique "feed back" circuit coupling a large motor generator combination. This equipment can provide continuous load tests up to 500 kva. or enough power for shop testing equipment rated up to 1,000 kva.

Besides requiring relatively little initial power, the feed back hook-up cuts down the amount of energy dissipated through resistant grids and artificial loads.

In testing a generator, part of the generator current is fed back to provide energy for the driving motors, much like the familiar "perpetual motion" idea. A motor under load test, drives the generator which also feeds back energy to drive the motor. Theoretically, once the set is running, the only prime energy required is enough to overcome friction and efficiency losses.

This company is still expanding and a new switchboard, larger machines and test facilities to handle still larger equipment under full load conditions, are included in their plans.

FIGURING Farm Wiring

Are prevailing unit prices for farm wiring producing sound business? This article raises the question and reviews farm wiring costs as a problem in estimating. The figures are based on actual experience by rural contractors in the middle west.

FARM wiring work is now running into millions of dollars. Much of it is in areas heretofore unserved by competent electrical contracting concerns. This has created problems in bidding and contract practice, unlike anything that the industry has previously tackled.

The situation is, essentially, that of doing old house wiring jobs on a mass basis. It is quite similar to the conditions that occurred back thirty to forty years ago when hundreds of thousands of homes were rapidly converted from gas to electricity. At that time, however, to handle this market there were many large electrical contracting concerns, across the country. Each had its sales crew and wiring crew. Each organization carried a huge volume of work. Relatively untrained salesmen quoted safely from price lists prepared by a competent staff of estimators, engineers, and accountants.

Farm wiring had no such happy start. Individual farmers contracted individually with anyone in their locality who claimed to be an electrician for a lump sum wiring job—and no specifications—no inspection. Then the REA insisted that the cooperatives adopt reasonable specifications and demand inspection before the service was energized.

A "group bidding plan" was set up whereby lots of 25 to 100 farm homes were let on competitive bid to one contractor. Then came the "established unit price plan," which now prevails in many of the cooperatives and has become the standard technique for letting farm wiring contracts.

Under the unit price plan, all those interested in electric wiring in the area

are called into a meeting with representatives of REA and the cooperative. A price structure for farm wiring is set up and agreed upon to apply to that project.

The technique, though sound in principle has often resulted in seriously inadequate unit price schedules. Projects only 100 miles apart may have prices varying as much as 50 per cent. In many instances this has been because the electricians and contractors who attend the price conference are relatively untrained in business. Though able mechanics, they have only a vague knowledge of material and labor costs.

But there is no mystery to estimating farm wiring. Unit prices must necessarily cover average conditions, so that the great majority of the jobs will actually be installed under the conditions presupposed in setting up the unit. So the first job is to break down the proposed work into convenient units, such as meter loop, service entrance, distribution cabinet, and the various types of outlets.

The following list of elements is sufficiently detailed for the ordinary project:

1. Meter loops
2. Service entrances
3. Distribution panels
4. House outlets—
 - a. ceiling outlets
 - b. sidewall outlets
 - c. single pole switch
 - d. three way switch
 - e. duplex receptacle
5. Out building outlets—
 - a. light outlets
 - b. single pole switch outlets
 - c. receptacle outlets
 - d. hay mow light and switch
6. Yard lights—
 - a. yard light and single pole switch
 - b. yard light and 2-three way switches
7. Weather-proof outside wire installed

Under each of these headings, of course, further sub lists are made covering the varieties of characteristics that will be encountered in the average project. A detailed list of material items required for each unit is then made up and priced. The labor, job expense, overhead and profit are then added to give the total unit price.

Once such a list of labor units is established, figuring farm jobs is a relatively simple calculation, that can be handled by anyone capable of adding a column of figures. But some care must be used, of course, in applying such a unit price schedule to all jobs.

Because of construction peculiarities, some farm houses may take several times the labor figured in the unit prices. Conversion jobs from local lighting plants may also be encountered, where the unit price schedule cannot be used. In such cases, it is necessary for the contractor to visit the premises and figure the job on the basis of the conditions that exist.

Also, it is entirely ethical for the contractor to introduce an "escape clause" into his contract. This will permit him to refuse the job if he finds exceptional conditions on the premises.

Analysis of Costs

A detailed analysis of unit prices is given here on the opposite page. The labor costs are based upon the labor hour figures shown in a table published in our November 1939 issue.

It is important to note, however, that these material prices should be checked with your own prevailing prices and purchasing quantities. Material prices vary somewhat over the country, although no great variation should be found.

Material prices will also vary as a result of difference in specifications. Most projects use a simple specification based upon the minimum standards of the National Electrical Code, with a few additional rules pertaining to farm wiring. Other projects, notably in Indiana, require No. 12 wire circuits on all first floor outlets. The choice of wiring system will also affect material price, although non-metallic sheath cable is now practically standard throughout the country.

The labor units shown are those of experienced rural contractors, and are compiled and averaged from several sources. It is impossible to set up a standard labor unit that will apply throughout the nation on all kinds of projects. Therefore, it is up to the individual contractor to adjust these to his

own labor cost by reference to his own experience.

Labor hour figures on farm wiring work varies more than labor hour units for commercial and industrial work in cities. The farm electrician may have experience ranging from two weeks to ten years. The city electrician has usually passed through a prescribed apprenticeship period tending to standardize methods and ability.

A common error of many rural con-

tractors is to set up a price schedule on the basis of their own experience and ability as wiremen. Too often they find that the men they hire are incapable of handling the work at any such speed. Figured in dollars and cents, this difference is frequently washed out by the custom of rural contractors of paying men on a scale depending upon their ability. However, it cannot be too strongly urged that the contractor keep accurate labor studies on as many of his

jobs as possible, to provide an accurate check on his estimated labor cost.

Keeping detailed labor studies on every job that the contractor handles involves a difficult and unnecessarily expensive job of bookkeeping. However, several rural contractors have been able to get accurate labor cost studies for all of their projects by taking sample studies of each fifth or tenth job, depending upon the volume of business.

[Continued on Page 24]

GROUNDINGS

Detail	1	3/8 x 8 copperweld rod	1.36
	1	clamp	.32
		#6 bare copper wire	.30
		misc.	.03
Total material			2.01
Labor .8 m.h. at .70			.56
Tax and insurance			.04
Net cost			2.61
Overhead and profit			1.12
Unit price			3.73

SERVICE ENTRANCES

Size of Service	2#8	3#8	3#6	3#4	3#2
Cable	1.23	1.86	2.36	3.18	4.46
Head	.28	.28	.28	.28	.28
Sill Plate	.15	.16	.16	.16	.22
Straps & Connector	.24	.24	.24	.24	.24
Material	1.90	2.54	3.04	3.86	5.20
Labor	1.23	1.40	1.40	1.75	1.75
Tax & Insurance	.09	.11	.11	.13	.13
Net Cost	3.22	4.05	4.55	5.74	7.08
O & P	1.38	1.74	1.96	2.46	3.04
Unit Price	4.60	5.79	6.51	8.20	10.12

FARM BUILDING OUTLETS

Type of Outlet	Lamp Rec.	S.P. switch	Yard light on S.P.	Yard light on 3 ways	Hay Mow light	Plug rec.
Cable	.66	.44	.67	1.68	1.12	.43
Boxes	.15	.13	.23	.38	.23	.13
Straps & Leads	.08	.05	.42	.76	.10	.05
Devices		.29	.24	.72	.22	.15
Steel Tube					.62	
Fixtures	.19		1.80	1.80	.19	
Misc.	.02	.02	.05	.05	.02	.02
Material	1.10	.93	3.41	5.39	2.50	.78
Labor	.84	.77	2.28	3.74	1.75	.77
Tax & Ins.	.06	.06	.17	.28	.13	.06
Net Cost	2.00	1.76	5.86	9.41	4.38	1.61
O & P	.84	.76	2.52	4.02	1.94	.70
Unit Price	2.84	2.52	8.38	13.43	6.32	2.31

NOTE—Material prices are prevailing published prices of national manufacturers. Labor prices are formed on units shown on page 61 of Nov. 1939

FARM WIRING COSTS

Detailed Cost Figures on Service Entrances, Distribution Panels, House Outlets, Farm Building Outlets, Meter Loops and Grounds—Based on the Experience of Contractors.

METER LOOPS IN CONDUIT

(Disconnect switch omitted) 5 wire #6 (bare neutral)

Detail	15 ft.	1 1/4 in. conduit	2.25
	1	1 1/4 in. service head	.48
	75 ft.	#6 R.C. wire	1.77
	19 ft.	#6 bare copper	.38
	4	straps	.20
		solder tape, etc.	.25
Total material			5.33
Labor 4 m.h. at .80			3.20
Tax and insurance			.24
Net cost			8.77
Overhead and profit			2.92
Unit price			11.69

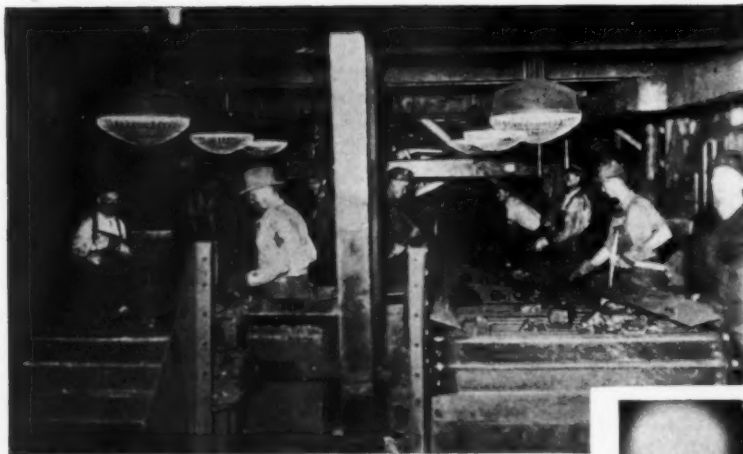
HOUSE OUTLETS

Type of Outlet	Ceiling	Bracket	S.P. switch	3W switch	Plug rec.
Cable	.45	.43	.43	.76	.55
Box	.21	.15	.10	.10	.10
Device			.16	.22	.08
Plate			.04	.04	.04
Misc.	.05	.05	.05	.05	.05
Material	.71	.63	.78	1.17	.82
Labor	.87	.77	.91	1.02	.91
Tax & Ins.	.07	.06	.07	.08	.07
Net Cost	1.65	1.46	1.76	2.27	1.80
O & P	.71	.63	.76	.98	.77
Unit Price	2.36	2.09	2.52	3.25	2.57

DISTRIBUTION PANELS

Size of Panel	30 amp 4 cir	60 amp 4 cir	60 amp 6 cir	2-15 2-20 CB.	4-15 1-20 1-50 CB.
Panel	4.00	4.90	7.25	6.00	7.20
Board	.30	.42	.42	.42	.42
Fuses	.18	.46	.52		
Misc.	.25	.25	.25	.25	.25
Material	4.73	6.03	8.44	6.67	7.87
Labor	.70	1.19	1.54	.70	1.54
Tax & Ins.	.05	.09	.12	.05	.12
Net Cost	5.48	7.31	10.10	7.42	9.53
O & P	2.36	3.14	4.34	3.19	4.10
Unit Price	7.84	10.45	14.44	10.61	13.63

Electrical Contracting at an average labor rate of .70 per hour. Tax and insurance is 7 1/2% of labor overhead and profit is 43% of net cost.



PICKING TABLE—Operated at high efficiency with 250 footcandles from high intensity mercury-vapor lamps.

LIGHTING of Coal Tipples

**Special lighting required
for inspection of coal on
its way from mine to car**

By C. E. EGELER *General Electric Co.
Nela Park, Cleveland*

IN coal tipples the coal is broken, picked, graded for size, cleaned and finally loaded on cars for shipment. Some control can be exercised over the quality of coal sent to the surface but closer inspection is necessary before shipment is made. The coal is passed on conveyors in front of experienced men who throw aside all pieces which are too low quality or contain undesirable rock and waste material. The color and quantity of light are important factors, hence special illumination is required.

In different mines the extent, types and colors of waste material will vary somewhat, as the visual tasks are not always identical. In some locations change from high wattage lamps to daylight quality has improved the picking operation. More recently light of high intensity mercury-vapor lamps has produced outstanding results, through better contrasts. Very high levels of 200 to 500 foot candles from 400 watt lamps have worked excellently. In the photograph, the 400 watt units, spaced approximately four feet apart over each table, with a mounting height of about

3½ feet above the working plane, deliver around 250 footcandles.

While coal cleaning operations are handled entirely by machinery, it has been found that levels of 15 to 40 footcandles are helpful to the operators. Too often 100 or 200 watt bare lamps, providing only two or three footcandles, are used in important locations. In this illustration the usual bare lamps have been replaced by deep dome units with 100 watt lamps to deliver about 15 footcandles. Under these conditions, workers feel less fatigue.

Since the depreciation from dust and dirt is unusually high, definite cleaning schedules for the lighting units must be established. Alternate washing and

dusting of the lamps and reflector interiors on a regular schedule every three weeks would not be costly in relation to the added illumination obtained. Also the use of relatively high wattages in the better lighted plants tends to reduce the number of units employed.

Night operation of the tipples and cleaning plants is frequent and railroad cars are constantly being shifted into position as the coal is loaded. Floodlighting of the yard areas, doorways and exterior stairways not only speeds up the work but reduces the accident hazard. The yards of the cleaning plants are often illuminated by 1000 and 1500 watt floodlights mounted at 40 to 75 feet above the ground.

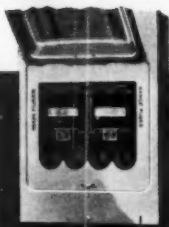


TIPPLE LIGHTING—High level illumination replaces the usual bare lamps with improvement in working conditions that has paid dividends through reduction of fatigue.

Cutler-Hammer 1940 Models



Model 4214-112 Switch
Type-4 Branch Circuit



Model 4214-112 Switch
Type-4 Branch Circuit



Model 4214-112 Switch
Type-4 Branch Circuit



Model 4214-112 Switch
Type-4 Branch Circuit



Model 4214-112 Switch
Type-4 Branch Circuit

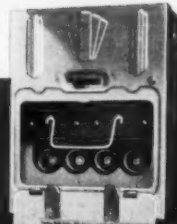
— 10 AMPERE FUSE BOX AND 2 AMPERE SWITCH WITH 2 AMPERE CIRCUIT —



Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere

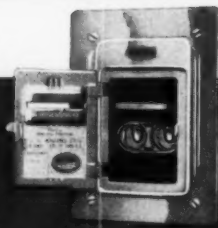


Model 4214-117 Switch
Type-60 Ampere

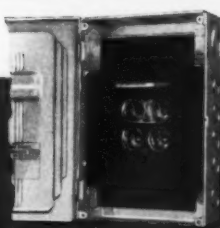
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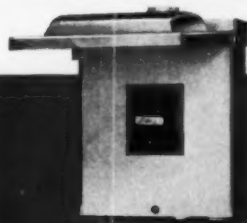


Model 4214-117 Switch
Type-60 Ampere

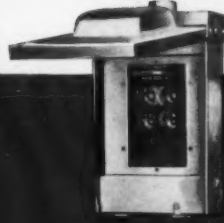
— 10 AMPERE FUSE BOX AND 2 AMPERE SWITCH WITH 2 AMPERE CIRCUIT —



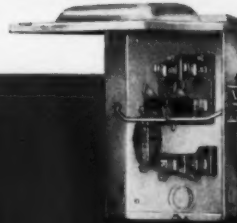
Model 4214-117 Switch
Type-60 Ampere



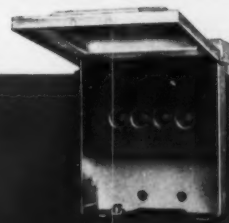
Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere



Model 4214-117 Switch
Type-60 Ampere

The greatest array of Modern Service Equipment complete
everything you want all new last-minute styling avail-
able from your Cutler-Hammer wholesaler. CUTLER-HAMMER, Inc.,
Pioneer Electrical Manufacturers, 1306 St. Paul Avenue, Milwaukee, Wis.



"Dillee"



*"The Finest Wire
Ever Made"*



BRANCHES AND DISTRIBUTOR STICKS

National Electric Products Co

(Figures based on size 14 wire)

		Minimum Overall Diameter	Price Ratio
①	"Dilec" 50° Code	.184	1.00
②	"Dilec" 60° Performance	.184	1.37
③	"Dilec" 75° Type RH (Heat Resisting)	.184	1.63
④	"Dilec" 50° Type RW (Moisture Resisting)	.184	2.90
⑤	"Dilec" 75° Type RHT (² / ₆₄ " Thin-Wall Heat Resisting)	.152	1.62
⑥	"Dilec" 60° Type RU (Latex)	.130	2.00
⑦	NE-Synthetic 60° Type SN	.130	3.45

A "Dilec" Wire for every purpose with outside diameter smaller except in the case of which is the same diameter as Synthetic.

*"The Smallest Wire
Ever Made"*



STOCKS IN ALL PRINCIPAL CITIES

Corporation · Pittsburgh, Pa.

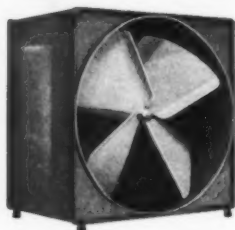
THERE ARE PROFITS IN AIR CONTROL!

Stop Stale Air Losses

in
Factories, Offices
and Stores with

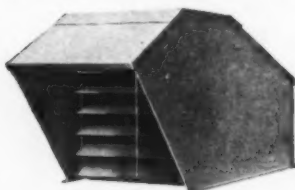


COMFORT VENTILATION



MODEL SK—EXHAUST UNIT

Fresh air in motion cuts production costs for the manufacturer by eliminating worker fatigue and error caused by stale air. Air circulation helps the managers of stores and restaurants to increase sales by providing more desirable and healthful conditions for patrons.



ROOF MODEL

In the REX-AIRATE line are the widely adaptable SK models, the Roof Model, Floor Circulators, and Window Ventilators. REX-AIRATE features include:

- Belt drive for quiet running
- All-steel construction
- Full range of sizes
- Reliable capacity ratings

Another fast-selling REX-AIRATE unit is the "Attik-Pak"—a complete package attic ventilator for homes.

WRITE TODAY for the booklet "Comfort Ventilation" and for full details on our money-making line.



Div. of The Cleveland Heater Company
1935 West 114th St.,
Cleveland, Ohio

Figuring Farm Wiring

[FROM PAGE 19]

Transportation of the wiremen to and from the job must be figured in overhead or as part of the direct job expense. Good business demands that an employee using his own car receive some compensation for the expense of operation. Some rural contractors provide gas and oil, the more business like, however, pay three to five cents per mile to the wireman for the use of his car. In the accompanying unit price table, the cost of transportation is included in the overhead mark-up. If this item is figured separately, it may be included with tax and insurance. A reasonably close approximation may be estimated by the following method.

Assuming two men to one car, an average of 20 miles per day, at a rate of four cents per mile, the cost of transportation per labor hour would be

$$20 \times .04 = .08 \text{ or } .05 \text{ per hour per man.}$$

Maintain Standards

In spite of learned theories of agricultural engineers, interested in getting farm wiring as cheaply as possible, there are economic limitations on the price that electrical contractors must get for the work. In spite of experiments with wiring schools for farm boys and the like, the skilled electrician is still worth the higher wage he commands.

There is no reason why the materials used in farm wiring should be lower in quality than those which the city contractor installs in city homes. Rural Electrification officials are continually insisting upon high quality materials in cooperative specifications. With a few exceptions these materials have been generally used for a number of years in residential construction. They are already made and sold on a machine production basis. And cooperative buying and other methods of short circuiting distribution costs cut little from the net prices already available to the contractor who buys in quantities.

The overhead and profit structure assumed in the accompanying figures is taken from the statements of electrical contractors. It represents a mark-up of 43 per cent on net cost, or 30 per cent (25 per cent overhead and 5 per cent profit) of the selling price.

There are few business organizations of any kind that can operate on an overhead structure of less than 25 per cent. Electrical contractors doing a business

of \$5,000 to \$10,000 a year usually find their own overhead costs far in excess of that figure.

Is good wiring installed by competent electrical contractors on a business like basis too expensive for the farmer? Not until some "Authority" tells him so. And, no one expects the electrical contracting industry to subsidize farm wiring by performing the work at a loss.

The unit prices shown are based on prevailing prices, average labor time, and a reasonable wage scale at a fair margin of profit. These are not "standard" price lists nor is it intended that they be adopted by any group of contractors on any project. They are presented in this form as an example of the way unit prices should be computed and the details that should be considered.

Each group of contractors in each cooperative area should set up its own unit prices. They should be sold to cooperative officials on the basis of prevailing material prices and methods of buying, individual labor experience and rates, and a mark-up based upon local business practice.

These prices ought to be the lowest that sound business methods will allow. But a price schedule once established too low is hard to revise upward. It is then necessary to adjust quality downward to fit the price. And that hurts everybody.



EXPORTER, Marvin M. Gleason, President of M. Gleason Co. electrical contractors and motor repair shop of Binghamton, N.Y., believes in trying anything once. He now enjoys quite a large export business in rewound motors. He changes the voltage, phase and cycle characteristics of motors for a large manufacturing company which sells its product in foreign countries.

Electrical Contracting, April 1940

FIRST AID

ON
ANY
JOB

No matter how you use tape—for splicing, wrapping a joint, or any kind of electrical work—U. S. Tapes are just what the doctor ordered to give you “Service Beyond Price and Specifications”.

SECURITY FRICTION TAPE

Non-Raveling
Straight Tearing
Strong Adhesion

SECURITY RUBBER TAPE

High Tensile Strength
High Dielectric Resistance
Fuses Perfectly



UNITED STATES RUBBER COMPANY
ROCKEFELLER CENTER
NEW YORK CITY

Editorials

Earl Whitehorne, Editor

Boost Rewiring!

Small diameter wire is here—and with the permission of local authorities, we can “go to town” with it. And there are hundreds of buildings where overloaded circuits groan for want of this wire, and adequacy demands that something be done to relieve this congestion, if only a little at a time. And this can be done.

Although we, as contractors should and of necessity must, view the job as a completely remodeled system from service to the smallest outlet, we can, where necessary, offer our customer a flexible step by step plan to accomplish this.

Sometimes budgets may not allow the rewiring of an entire building at one time. But in such cases, as new tenants lease space or old tenants renew their leases the rewiring job can be done to suit the needs of those tenants. Once the service is enlarged, modernization can proceed in any degree desired—from a single branch circuit to an entire building.

There will be plenty of this business in the months ahead. But ground work has to be done before these jobs materialize. Contractors are in close touch with their local realty owners, and should tell these owners about all that rewiring can mean to them and to their tenants. Be prepared to survey existing systems and make your recommendations for changes. There's sure to be real profit in jobs that are intelligently sold.

Resort Business

Now is the time when city folks are paying quick weekend visits to their shore cottage or mountain cabin

to get the place in shape for the vacation season. And that means an opportunity for nearby contractors to sell wiring and repairs.

A little extra selling effort can work up extra profits. Write to the owners early at their city homes. Offer a pre-season check-up, covering inspection of lamps and fuses and oiling motors. Use the job as a door-opener for selling extra outlets and appliances.

The early approach is essential, later the customer's dollars are diverted to screens, fishing tackle and snake-bite remedy. And that is tough competition.

Light the Roads

While many regions with superabundant electric power from great government projects are worrying about what to do with it all, the Rocky Mountain Electrical League is looking for the answer in highway lighting. Good hunch!

Traffic is taking such toll of life on crowded highways that the figures mount like war casualties. No greater public service could be performed than to light the highways, the heavily traveled arteries, the grade separations, the dangerous crossings. Effective safe use of highways could be increased without building new roads so soon.

To show its good faith and to demonstrate its belief the League is installing and operating at its own expense a sample of what it means just outside of Denver. A dangerous bridge crossing, at which a number of deaths have occurred, has been lighted and a big sign placed so that the pub-

lic may take heed of what lighting means to safety.

There will be work for many contractors if such a program spreads to cover the highways of the nation with a network of safety lighting. Here is an idea in public service worth promoting in any state or city.

Switch Receptacles

The practice of leaving out the central fixture in the living room of new homes, whether right or wrong architecturally, is no excuse for eliminating convenient switching. Most standard duplex receptacles can be split on two hot conductors, one connected through a switch or set of three-ways and the other unswitched through to the panel.

Clocks, radio, appliances and occasional lamps connect to the through feed, floor and table lamps used for general lighting connect to the switch leg. It is a simple, logical arrangement and might well be adapted to all jobs whether ceiling fixtures are used or not.

Power Company Work

Electrical contractors are doing more and more power company construction work. That is because there is less of it to do now that territories are well covered with lines. And it is hard for the utilities to give their construction crews steady work. So they are turning to the contractors and letting work out. This practice will steadily increase.

Every contractor, who is of a mind to do this kind of work, should get acquainted with the engineering staff of his local power company. Sell them on your competence and responsibility. Show them the advantage of making a clean cut contract job of the new line, thus avoiding labor troubles and cost arguments with regulatory bodies.

Air Conditioning Ahead

Another summer season in the offing reminds us that it is about time to dust off the prospect file and go after some appropriate seasonal business.

Electrical Contracting, April 1940

Fans will be sold as usual by drug stores and gas stations, but there are still a lot of folks who have the quaint notion that the best place to buy electrical equipment is from a responsible electrical dealer. Let's prove they are right.

Attic ventilators will also be very fashionable when the mercury starts to climb. And from the experience of last year, it looks like they will account for a sizable chunk of the plus business contractors will be bringing in this summer.

Room air conditioners are better than ever and lower in price. This has been anybody's business up to now. It might as well be yours.

An Object Lesson

An eastern contractor, while making an inspection of one of his jobs, saw this. One of his electricians picked up a length of conduit, made an offset in it, tried to fit it into place and finding it didn't fit, discarded it, picked up a new length and began to bend it.

The contractor walked over to the man, tapped him on the shoulder and threw sixty cents on the ground. "Would you do that?" he asked the man, pointing to the money.

"Why, no. I never throw my money away," answered the man.

"But that's just what you've done to mine," replied the contractor.

No further reprimand was necessary for the electrician, a bit crimson under the collar, shamefacedly apologized and went about his work. Further checkups on this job and others revealed a notable reduction in material wasted.

Strange as it may seem, the age old object lesson has its place even in the electrical contracting business.

Caution Needed

Willard Brown, Illuminating Engineer of the General Electric Company, in a recent talk on new developments in the lighting field, urged the recommendation of high intensities in selling fluorescent lighting for general illumination purposes. Says Mr. Brown, "Fluorescent light, today, is too feeble a light source to hang here and there; it must be used in large numbers to get satisfactory results. Don't sell the cus-

tomers 20 foot candles of daylight fluorescent light, aim for 40 or 50 footcandles. For 20 foot candles is equivalent to a cloudy day outside and will be very disappointing when installed."

The intensities of these new lamps as compared with the incandescent lamps of the same size, many cause us to be a bit hasty in making recommendations that will prove to be too low in actual practice. And we'll be sorry.

But let's give ample study to every job. This new lamp is still in its infancy. But it is growing and improving rapidly and at the present rate it may not be long before it bursts forth in full bloom. But until then, let's heed these caution signals that are thrown our way now and then, and give the subject some real thought. Remember, a dissatisfied customer is worse than no customer.

Low Cost Houses

It is an unmistakable fact that the major present trend in home building is toward low cost homes—of the \$2,500 class. A recent survey made by the Architectural Forum magazine indicates the volume in 1940 will be 60 percent above the 1939 total which was estimated at 60,000. This means that 96,000 of these homes will be built this year.

Now what does this mean to the electrical contractor? It means a nice bit of business. Let's take an average figure of \$100 for the electrical work in each home—and multiply this by 96,000. A large imposing figure of \$9,600,000 appears—and that's a nice bit of business in any man's language.

Now most contractors will figure there's no profit in a \$100 job. But let's not forget, these homes will be built in groups of 20, 40 or even 200 or 400—and on that basis it begins to take on the proportions of a sizable electrical contract. And there is a nice profit in this type of work if—and here's the key to it all—if the contractor will organize for mass production. That is the basis on which builders are constructing these homes—and they're most certainly profiting by it—or they wouldn't be planning more of them.

Mass production has found its way from the manufacturing plant into the realm of the construction industry. And we contractors must follow suit if we want to reap the harvest of this new business.

Wiring Space

With single gang switch combinations, more three-way and larger branch circuit conductors, many contractors have standardized on the 4-inch square box and switch cover for wall outlets.

The difference in cost over switch boxes is slight but the use of the bigger box makes the installation of larger wire sizes and ganged devices easier. It is a good practice.

Get Behind it Now

In 660 cities today there is a Junior Chamber of Commerce. Their total membership is more than 100,000 young business and professional men.

They have now launched a "Safety-With-Light Program" that is doing things. They are building public and political opinion against the present waste of life through night traffic accidents. As a cure, they are promoting safety lighting on highways. They are building publicity in many ways and getting results.

Electrical contractors who have overlooked this, better wake up—both as citizens and as business men. Get behind this movement in your locality. Get ready to install this highway lighting when it comes your way.

Who's To Blame?

A small town electrician, now graduated to the ranks of a house wiring contractor, was queried as to why he decided to go into business for himself. Wouldn't he be better off if he worked for a contractor?

"No," he answered, "I could only make a few dollars a day working for a contractor. Now I can make five or six dollars a day doing house wiring myself. And I don't have any overhead. What I get above material costs is mine."

And we grumble about poor competition and price cutting by these little fellows. Who is to blame for all this? We wonder.

Maybe if we tried for a fair price and stopped this price cutting, we could all make a fair profit and our men could make a fair living. Then they wouldn't be forced to go into competition with us. We can't condemn a fellow for wanting to make a fair living. All we can do is disapprove the method he uses.

WIRING Methods

DUMMY FUSES FOR LOAD TESTING

In order to make running load tests on motors without disconnecting leads, Herbert G. Martin, Inc., electrical contractors of Yonkers, N. Y., use dummy fuse cartridges to insert in circuit fuse gaps.

The links were removed from the cart-



FUSELESS FUSE CARTRIDGES are used with circuit tester to measure running loads on motors.

ridge fuses and the blades soldered to the ferrules. Stud bolts with wing nuts were soldered to the metal ring on each end of the ferrule. An ammeter connected to the studs, bridges the fuse gap when the cartridge is inserted, and records the current in that leg of the circuit.

A set of cartridges from 30 to 400 amperes, 250-volt size were made and are used with a circuit tester. A similar set could be made for 600-volt circuits, using the proper cartridges.

REMOTE CONTROL PANEL

Remote control of a large number of motors, in the West Vaco Chlorine Products Company plant at Newark, California, is accomplished by grouping pilot equipped control buttons on the desk top of a central control panel. Drum controls for large motors are also mounted on this panel. Temperature and other recording instruments are mounted on the face of the vertical panel. Thus, one man has at his fingertips the control of all motors relative to that particular process.

HEAVY CONDUIT SUPPORT

Heavy gauge flanged steel plates, reinforced with conduit spacers were used to support heavy conduits in an industrial installation by the L & P Electric Co., electrical contractors of Brooklyn, N. Y.

The plates were made of No. 10 gauge steel with an upper flange which is mounted flush with the ceiling and a lower flange on which the mounting bolt heads rest. These supports were secured to the concrete ceiling slab by means of bolt anchors and two long bolts running the full length of the plate. Rigid conduit spacers fitting over the bolt snugly between the flanges prevented the plates from buckling when the bolts were tightened, and also gave added rigidity to the support. Holes cut into the plate supported the heavy conduits. Future conduits can be supported by these hangers by simply drilling new holes in the unused area of the plate.

This "flanged plate" type of support



SWAY-FREE supports made of heavy gauge flanged steel plates permit rigid suspension of low hung conduits.

reduces lateral sway of the conduits to a minimum and is exceptionally rigid. It is exceptionally useful where conduits must be suspended some distance from the ceiling to clear right angle runs of other pipes and conduits. The dimensions of these supports vary with specific job conditions.

ACCESSIBLE PULL BOX

The Pacific Electric Motor Co. of Oakland, California, had accessibility and installation ease in mind when they designed and installed a long wiring trough above a distribution panel in



FINGERTIP CONTROL. This group of buttons affords remote control of a large number of motors from a central point.

"UNDERGROUND" use *Orangeburg* **NOCRETE CONDUIT** for **2** **EXTRA PROFITS**



NOCRETE conduit
assures you of:

① Savings in material costs

Orangeburg NOCRETE conduit is about half the cost of metal pipe and less than non-metallic conduits of any comparable quality. Ask our representative for prices. Extra couplings and all types of fittings, elbows, bends, etc., are available.

② Savings in installation costs

It "handles easy": light in weight, in handy 5 or 8 foot lengths (in various sizes) this super-study duct will surprise you by its adaptability. It assembles and installs easier, faster and at a lower cost than any conduit you have ever used. It is readily cut and fitted with ordinary wood-working tools.

Approved by Underwriters' Laboratories, Inc. for installation underground (without concrete encasement) — Guide Card 80-014 File E 2557

- ① Savings in material costs.
- ② Savings in installation costs.

Perhaps you now have a house connection to make, a garage or barn to hook-up; an industrial power, lighting or signal service to install? Use it for that underground "run" and you will realize its profit opportunities.

NOCRETE, for installation underground without concrete encasement, is a new development of "ORANGEBURG".

For 47 years "ORANGEBURG STANDARD" has been used by the electric industry for power raceways underground-encased in concrete.

Now, new **ORANGEBURG NOCRETE** for the first time makes this premier quality raceway material economically and practically available for the smallest job as well as the big distribution project,—no concrete required.

—And, it is easy to get from our

Sales Agent—Distributors

GRAYBAR ELECTRIC CO., INC.
GENERAL ELECTRIC SUPPLY CORP.

Sales Offices near you—warehouses for prompt delivery within your district.

MADE AT ORANGEBURG, NEW YORK
BY THE FIBRE CONDUIT COMPANY
292 MADISON AVE. NEW YORK CITY

EXTRA



HAZARD RE-

Published by the Hazard Insulated Wire Works,

NEW SMALL DIAMETER BUILDING

Large Office Building Rewired with Type SN Small Diameter Wire

EXISTING RACEWAYS USED—OWNER MADE BIG SAVING

An office building, built in 1912, consisted of brick, steel and concrete construction of four stories with basement. The building was approximately 54 feet wide by 195 feet long. Floors were of reinforced concrete 4½ inches thick with 1-inch finish and plaster applied direct to under side of slab. Interior walls and partitions were of 4-inch gypsum block and plaster. The branch circuit conduits were ½-inch size and contained No. 14 standard Code wire. A total of 937 outlets were already in the building.

It was desired to increase the illumination. The original and increased wattage of fixtures is shown in the table below.

Location	Old Units (watts)	New Units (watts)
Basement	150	200
Display Room	500	2400
Bookkeeping	200	1000
Executive Offices	300	1500
General Offices	200	750
Rest Room and Minor Offices	200	500
Stairwells	75	150

After a study of the additional copper necessary for branch circuits, the following combinations were worked out:

- 6—No. 12 Conductors in ½-inch conduit
- 4—No. 10 Conductors in ½-inch conduit
- 2—No. 8 Conductors in ½-inch conduit

These conductors had synthetic coverings of 2/64-inch thickness without braid, and were used to avoid any combination which would exceed 50 per cent fill of the conduit.

In wiring for the 2400-watt fixtures on the display floor, the old circuit arrangement was changed from two outlets per circuit to two circuits per outlet. All boards were changed from 3-wire, 120-208 volts to 3-phase, 4-wire, 120-208 volts. By the use of thin-wall synthetic insulation, the watt capacity of existing conduits was increased two and three times regular Code standards.

The electrical contractor experienced no difficulty of any kind in installing the conductors. The pulls were easy even on long runs, and no lubricant was necessary. Voltage breakdown tests on the thin-wall insulated wire after pulling in place showed an average of 9500 volts. The insulation was not perceptibly marked or gouged during the installation process. Temperature tests were taken with six No. 12 synthetic covered conductors installed in ½-inch conduit encased in 2 inches of concrete with each conductor carrying 18 amperes. Maximum sustained temperature under these conditions was 61 degrees Centigrade based on an ambient of 40 degrees C. This temperature is within the limits set by the manufacturers of the particular conductor used.

About 150 additional branch circuits were provided together with 90 additional outlets. A complete change of the basement vault and transformer installation was also necessary. The original system consisted of three 100 kva, single-phase transformers, a switchboard of slate panels mounted on pipe frame work, and fused knife switches for main feeder control. In order to provide adequate service facilities for increased load, the vault was



A General Office after Modernization.

enlarged for two banks of three 150 kva, single-phase transformers, each with arrangements for a street tie equivalent to the capacity of each bank. A 1600 ampere air circuit breaker was installed for the main service.

It should be particularly noted that when new materials such as thin-wall conductors are used to increase wattage capacities and branch circuits in existing conduits, the additional loads require increasing feeders, mains and service equipment as well.

All of this additional business was created for contractors, labor, wholesaler and manufacturer by the use of new ideas in wiring.

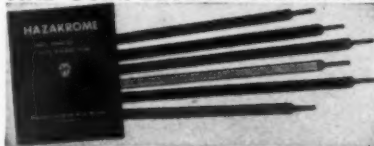
ELIMINATION OF BRAIDS AND FIBROUS COVERINGS FORWARD STEP IN WIRE DESIGN

New Wire Pulls Easily

HAZAKROME does away with braids or other fibrous coverings which take up valuable space.

The slick, smooth, waxed surface of HAZAKROME makes pulling through ducts easy. Each circuit is easily recognized by the standard colors of the insulation itself. Furthermore this new insulation is not affected by exposure to light. HAZAKROME is easy to install and . . . it lasts.

A WORKING KIT OF SAMPLES AND COMPLETE INFORMATION



A complete kit of samples of HAZAKROME wire containing the various colors and typical selections from the full range of sizes is ready for you.

In addition to the wire, the kit will contain complete data on the use of the wire as well as descriptive data which will be invaluable in figuring on rewiring jobs.

These kits and instructions are free on application. Be sure to write Hazard for yours today.

Capacity Doubled in Half-Inch Conduit by Using Small Diameter Wire

SIMILAR INCREASES FOR OTHER SIZES

Where two single phase circuits have been installed in a ½ inch conduit, previous National Electrical Code requirements permitted only 4-#14 wires to be installed. These conductors can be replaced with 4-#10 HAZAKROME Type SN small diameter building wires. Total circuit wattage will thereby be increased from 2800 watts to 5700 watts.

In a lighting circuit this means that the lamps can be doubled in size merely by using Type SN wire instead of ordinary Type R rubber insulation. No conduit changes are necessary. Typical examples of other possibilities are listed below:

Relative Conduit Capacity

	Ordinary Type R wire	HAZAKROME Type SN wire
1" pipe —	3 #8 wires (35 amps/conductor)	3 #2 wires (96 amps/conductor)
1½" pipe —	3 #1 wires (91 amps/conductor)	3 #3/0 wires (166 amps/conductor)

HAZAKROME Type SN Displays Convince Thousands at Shows



Hazard exhibits at The National Electrical Contractors Association Convention last year and at the New York and Boston Electrical Trade Shows have given thousands of contractors the information they need to go out after this new and profitable market.

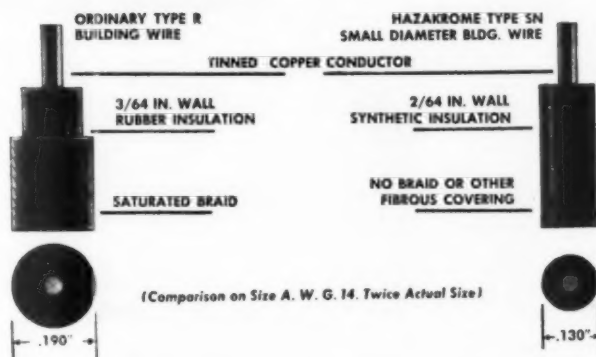
With this exhibit you can demonstrate just how easy it is to increase line capacity at minimum cost. Write Hazard at Wilkes-Barre to find how such an exhibit can be obtained.

Electrical Contracting, April 1940

Division of The Okonite Company, Wilkes-Barre, Pa.

WIRE OPENS TREMENDOUS MARKET

HAZAKROME Type SN Offers Obvious Advantages



(Comparison on Size A. W. G. 14. Twice Actual Size)

Comparative Outside Diameters

A. W. G. SIZE	Ordinary Type R Building Wire Approx. O.D. Inches	HAZAKROME Type SN Small Diameter Approx. O.D. Inches
14 sol.	.190	.130
12 "	.210	.147
10 "	.230	.168
8 "	.280	.227
6 str.	.380	.314
4 "	.450	.363
2 "	.510	.423
1 "	.570	.496
1/0 "	.630	.537
2/0 "	.670	.583
3/0 "	.730	.634
4/0 "	.780	.692

The 60° C. maximum recommended operating temperature of HAZAKROME Type SN as against 50° C. for ordinary Type R wire means greater possible current loadings (see adjacent table).

Comparative Current Loadings

A. W. G. SIZE	Ordinary Type R Building Wire Amperes	HAZAKROME Type SN Small Diameter Amperes
14 sol.	15	18
12 "	20	23
10 "	25	31
8 "	35	41
6 str.	45	54
4 "	60	72
2 "	80	96
1 "	91	110
1/0 "	105	127
2/0 "	120	145
3/0 "	138	166
4/0 "	160	193

The values shown above are for 1, 2, or 3 conductors in a single conduit as proposed for the 1940 National Electrical Code.

Type SN Synthetic Insulation Permits Greater Capacity Without Changing Conduits in Old Installations

HEAVIER COPPER OR MORE CONDUCTORS IN EXISTING RACEWAYS AT MINIMUM COST

The ever-increasing quantity of new electrical appliances, equipment such as air conditioning units, higher intensity lighting, etc., have made greater demands than existing wiring circuits are able to carry. Owners of commercial and industrial buildings, apartments and residences were faced with the great expense involved in ripping out small conduit from walls, floors and ceilings to install conduit large enough to carry the larger sized wires needed.

But, the introduction of small diameter building wire is saving owners this tremendous expense. These new wires are used in existing raceways thereby doing away with the need for tearing out existing construction.

Much work that has been held up because of the great cost of new conduit installation will now be released by owners, and electrical contractors are expecting to be kept busy for some time to come.

Interest has focused on HAZAKROME Small Diameter Synthetic Insulated Building Wire, which is made in all sizes up to and including 4/0. This slick, easy pulling, braidless Type SN Wire comes in all standard colors. Leatherlike in texture, it resists moisture, flame, oil, acids and abrasion, making it ideal in every respect for the work demanded of it. Electrical contractors are asking their jobbers (or writing to us in Wilkes-Barre) for samples and data on HAZAKROME.

HAZAKROME ALSO AVAILABLE FOR POWER CIRCUITS Synthetic Insulation Not Limited To Lighting Circuits.

Rewiring of important power and feeder circuits with larger conductors is made possible with HAZAKROME synthetic small diameter building wire as Type SN is available in all conductor sizes up to and including #4/0.

ADEQUATE WIRING A REALITY WITH HAZAKROME TYPE SN

4 Distinct Advantages

- 1 Smaller Diameters
- 2 Greater Current Capacity
- 3 Greater Permissible Conduit Fill (about 25% more than for ordinary Type R)
- 4 Non-inflammable Insulation

Each of these is important and money saving. Combine them all in one wire and you have compelling cause to specify and use HAZAKROME Type SN.

APPROVAL

Last December the Electrical Committee of the N.F.P.A. reported its approval of Small Diameter Building Wire. Until the report is formally accepted by the National Fire Protective Association and included in the 1940 National Electrical Code, its use in new work and rewiring is contingent upon approval by local inspection authorities.

Reports from various parts of the country indicate that local approvals to use small diameter building wire are generally being obtained upon application.



USE G-E SWITCHES AND CONVENIENCE OUTLETS FOR SPRING WIRING



GE3008 Sphinx Mercury Switch, single pole

GE3010 Sphinx Mercury Switch, 3-way

GE2841 Standard Switch, single pole

GE2514 Standard Switch, 3-way

GE2679 Twin Convenience Outlet

GE3052 Radio Outlet

GW-9200 Twist-Tite Convenience Outlet

GE2959 Weather-proof Outlet

GE3035 Fan Hanger Outlet

GU-91071 Uniline Switch Plate

GU-91101 Uniline Convenience Outlet Plate

The spring building market is open. You'll be installing electrical switches and convenience outlets by the dozen in the buildings you wire. For your own benefit and your customer's benefit choose items from the complete General Electric line. They are easy to install and will give lasting dependable service. The line includes the silent Sphinx Mercury Switch, the G-E Standard Switch completely insulated with Textolite, a Standard Twin Convenience Outlet, the Twist-Tite Convenience Outlet and many outlets for special purposes. Many devices are also furnished in ivory color to match modern finishes. The G-E Monogram will help you sell wiring jobs too. Your customers know that it stands for quality and dependability. For more information about G-E Switches and Convenience Outlets see the nearest G-E Merchandise Distributor or mail coupon at right for a G-E Wiring Device Catalog.

General Electric Company
Section D-0124
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me a copy of the G-E Wiring Device Catalog.

Name.....
Address.....
City..... State.....

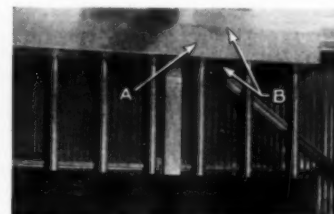
GENERAL  ELECTRIC

WIRING Methods

[FROM PAGE 28]

the West Vaco Chlorine Products plant at Newark, California.

The removable cover is bent L shape and forms part of the front and bottom



ANGLE COVER—L shaped cover (A), fastened by rows of screws (B), provides accessibility and pulling ease on this deep wiring trough.

of the trough. It is in two sections. This type of cover makes wire pulling easy and eliminates the hazard of injuring the conductor insulation during the pulling operation.

STEEL TOOL CHEST

Welded steel tool chests are used by the T. L. Rosenberg Co., of Oakland, California, on their electrical construction jobs. The box is rigidly constructed and has angle iron supports for the small parts tray which can be tilted and placed inside



STEEL CHESTS for contractor's tools on the job, reduces tool damage, non-productive job labor and speeds up construction work.

box when cover is closed. Handles at the sides make the box easily portable.

An inventory card mounted on the inside of the cover indicates the tools and equipment which should be in the box, and includes such items as electric drills, stocks and dies, hickies, fish tapes, solder, tape and miscellaneous small supplies.

Reduction of tool damage due to dampness and water, long life of the steel chest and resultant saving in labor by having several of these small boxes on a job, soon pays for the initial investment.

Electrical Contracting, April 1940

WHY WASTE VALUABLE
TIME AND MONEY?
JUST CALL ON..

Appleton

FOR ALL ELECTRICAL FITTINGS!



Wide-awake contractors depend on Appleton to supply the exact electrical fitting they want, for each and every need. They know how to save time, money, and energy . . . how to get their requirements handled quickly, economically, completely, and efficiently.

Appleton is the *one* place to get *all* fittings . . . the broadest line, the newest line, the finest-quality line . . . all under the famous name: Appleton.

This alert organization is also well known for the constant and untiring improvement of its products . . . *practical* improvements

for better service, timely advancements to meet the specifications of a changing industry.

No wonder wide-awake contractors call on their wholesaler to furnish APPLETON products for a fast and *right* solution to *every* electrical fitting problem.

SOLD THROUGH WHOLESALEERS

COMPLETE CATALOGUES AND BULLETINS SENT UPON REQUEST

• APPLETON ELECTRIC COMPANY •

1704 WELLINGTON AVENUE

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Branch Offices: NEW YORK, 78 Ninth Avenue • DETROIT, 2115 Woodward Avenue • CLEVELAND, 214 Hippodrome Bldg. • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 203 Luckie Street, N. W.

Resident Representatives: Baltimore, Birmingham, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, Minneapolis, New Haven, Philadelphia, Pittsburgh, Seattle.

Better Lighting

FLUORESCENT FLICKER

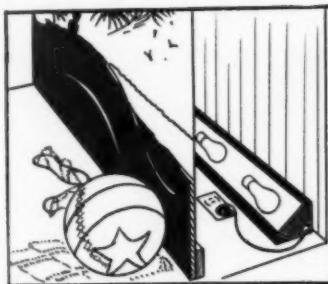
Operation of fluorescent lamps is practicable on 50 cycles. Auxiliaries are available for this frequency. The lamp itself will operate on 25 cycles, but the flicker is very pronounced. In the other direction, enough high frequency will cause the lamps to come up to fairly high output. But high frequency is a costly way to produce energy.

When burned in the usual manner on alternating current, every lamp has a non-uniform light output caused by the cyclic variations in current. This effect is, of course, increased at lower frequencies. In electric discharge lamps where practically no energy is stored, as it is in the hot tungsten in filament lamps, the light drops almost to zero along with the current between each half cycle. Fluorescent powder, however, except for the blue-fluorescing variety, has a persistence of glow or phosphorescence which helps to reduce flicker, the reduction being dependent on the phosphor used. With lamps burned on two or more phases or with a tulamp transformer the lamps operate out of phase and the fluctuation in light output is further reduced and becomes comparable to the variation in low wattage filament lamps. Here are the figures for different colors—

Flicker* of 15-watt Fluorescent Lamps
(Operated with reactors on 115-volt 60-cycle circuits)

Blue	95
Gold	20
Green	20
Pink	20
Red	10
White	35
Daylight	55
Daylight (Tulamp Auxiliary).....	25
White (Tulamp Auxiliary).....	16
15-watt Tungsten lamp (Approx.)	15

*Per cent deviation from mean light output.



TRANSLUCENT BACKGROUNDS—
Luminous backgrounds offer many opportunities for introducing artistic and eye-catching effects in window lights. For example, a translucent surface can be made of muslin, oiled silk, tracing cloth, thin paper or the like, stretched on a wood frame and lighted by trough reflectors behind. The decorations or signs can be either painted in translucent color on this surface or made as cutouts silhouetted in front. The merchandise can be picked out with spotlights from overhead to make the effect more striking.



INDUSTRIAL LUMINAIRES give 60 foot candles in office. This 17,000 square foot space in the office of the Georgia State Employment Service in Atlanta is lighted by 99 silvered bowl industrial diffusing units, producing a maximum of 60 foot candles of high quality, soft shadow direct light. Fixtures are mounted on 9 ft. by 14½ ft. centers with the bottom of units 12 ft. from floor.

FLUORESCENT ENCLOSED SIGNS

In applying fluorescent lamps to enclosed signs, provide at least as many lumens as in using inside frosted filament lamps. Chart I indicates the required lumens and Chart II the lumens per linear foot. The spacing between rows of fluorescent lamps should not exceed the distance of the lamp from the glass enclosure. The usual situation will require a spacing of rows of lamps 6 or 8 inches apart.

The construction of signs is compar-

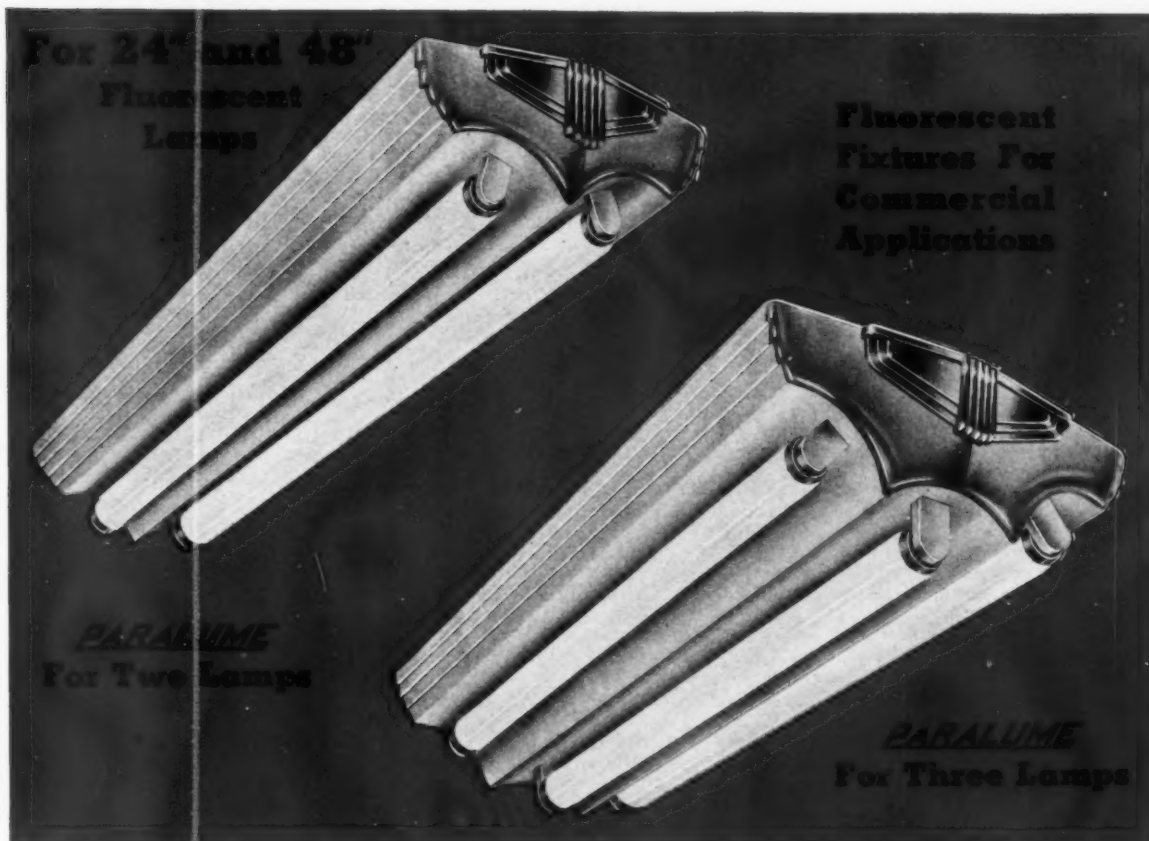


IT SETS 'EM UP—No theater stage ever had its stars better spot-lighted than this stock of wet merchandise in a Los Angeles super-drug store. Chrome finish conduit, holding the neat aluminum reflectors, direct additional light on this section of the shelving. The high intensity here serves to draw customers to the rear of the store.



PARALUME

Originally Announced as the "LIGHTMASTER"



The Day-Brite **PARALUME** . . . designed specifically for general lighting in all types of commercial installations.

Maximum wide-spread downward illumination is provided for lighting merchandise displays, counters, or desks with sufficient upward and outward lighting to give a smooth glare-free overall effect. Its sleek flowing lines make it applicable to all types of installations involving modern architectural treatments.

With the **PARALUME** lighting intensities can be increased over present lighting systems and in addition, the Fluorescent lamp for like intensities produces considerably less radiant heat, which will materially affect room temperature.

Furnished wired, with all necessary parts, ready to install.

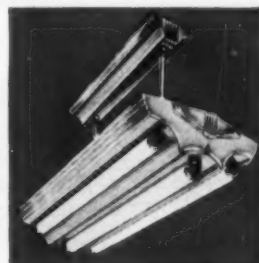
Bulletin F-20 is ready for distribution

Write for your copy NOW!

The **PARALUME** is available in two finishes, Satin Chromium and White Baked Enamel. Cast ends on both types are Satin Finish with polished ornaments. White sockets furnished with white fixtures and black sockets with chromium fixtures.

Easy To Install

These fixtures are available for 24" 20-watt and 48" 40-watt lamps. They are listed for direct ceiling mounting, but if desired can be furnished with decorative hangers for suspension as illustrated.



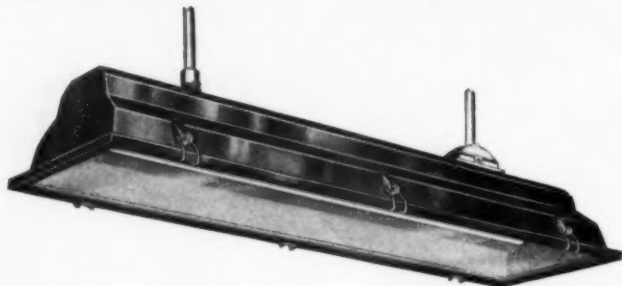
The "Paralume" is sold by your Electrical Wholesaler Contact him TODAY

Day-Brite Lighting, Inc.

5427 Bulwer Ave.

St. Louis, Missouri

THE NEW WHEELER VAPOR-PROOF FLUORESCENT LIGHTING UNITS



Wheeler VAPOR-PROOF Fluorescent Units are made for use in food plants, foundries, and similar locations where it is necessary to protect lamps, sockets and reflecting surfaces from moisture, dust, smoke and vapors.

In locations such as food plants where it is desirable to take extra precaution against lamp breakage, it is recommended that these units be equipped with safety sheet glass covers for maximum protection.

When used with the "Daylight" Fluorescent lamp, these new units provide a cool, efficient, color-corrected Daylight quality illumination which tends to reduce spoilage and rejects. Units are easy to install and easy to service.

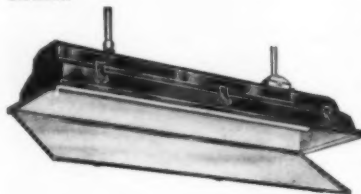
The entire outer body of the reflector, including its closed ends, is enameled in one piece. All sockets and lamp operating equipment are mounted on a wiring channel which is installed through the mouth of the reflector.

The mouth of the reflector has a recessed flange to receive the hinged glass cover which seats against cushioning gaskets to form a moisture and dust-proof seal.

All units are supplied complete with the latest type of ballast equipment employing separate and renewable starter switches. Two lamp fixtures are supplied with high power factor Tulamp ballasts resulting in an overall power factor above 95% and greatly minimizing any stroboscopic effect. A starting compensator is included in all two lamp units.

Capacitors for power factor correction can be supplied on all single lamp units.

Fixtures are furnished *wired*, with pigtails left for connecting to branch circuit.



HINGED DUSTTIGHT GLASS COVER

The Hinged Dusttight Glass Cover is readily opened for access to lamps or starter switches by releasing toggle latches. Units can be supplied with 7/32" Standard Safety Sheet Glass or with 1/2" Double-thick Plain Clear Glass.

For complete data write for New Bulletin No. 60-A

Distributed Exclusively Through Electrical Wholesalers

WHEELER REFLECTOR COMPANY

275 CONGRESS ST., BOSTON, MASS.

NEW YORK

ATLANTA

CLEVELAND



[FROM PAGE 34]

able with that used for filament lamps. Diffusing materials, either for translucent letters or translucent background, should have a transmission of the order of 40 to 50 per cent. Material should be selected on the basis of maximum transmission consistent with good diffusion. All interior surfaces of a box-



ENCLOSED FLUORESCENT signs. The positions of fluorescent lamps for the single and double faced types of signs are shown above.

type sign, other than the translucent parts, should be furnished with a good white paint or white porcelain-enameled metal.

Here is the procedure for determining required number of fluorescent lamps—

A. Select required lumens for type of sign and location from Chart I.

B. Select length and color of lamp.

C. Determine lumens per linear foot for B from Chart II.

D. Divide lumens per square foot (from A) by lumens per linear foot (from C) to determine footage (or rows of lamps) required. For double-faced signs, one lamp illuminates both sides, so multiply above result by two.

CHART I

Recommended Lumens per Square Foot of Luminous Area for Transmitted Light Signs*

	Luminous Letters **		Luminous Background ***	
	Single-faced	Double-faced	Single-faced	Double-faced
Bright districts, large cities...	1000-1500	800-1200	800-1200	600-900
Main streets, average cities...	800-1200	600-900	600-900	500-700
Business districts, small cities...	500-700	400-600	400-600	300-500

* Note that in double-faced signs one lamp illuminates both sides so that area per lamp must be doubled.

** Solid opal letters. Flashed-opal or other higher transmission materials will require less lumens.

*** Flashed-opal or other material having a transmission factor of 40-50 per cent.

CHART II

Lumens per Linear Foot — Fluorescent Lamps

	18-inch	24-inch	36-inch	48-inch
Green.....	600	650	750	...
White.....	355	380	440	470
Daylight...	300	330	370	400
Gold.....	250	270	310	...
Blue.....	210	230	260	...
Pink.....	200	220	250	...
Red.....	30	30	40	...

HERE'S HOW TO GET GOLD OUT OF THE COMMERCIAL REWIRING MARKET



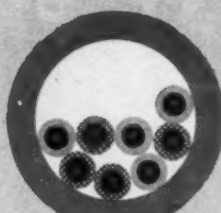
Small diameter U. S. Laytex Building Wire doubles capacity of existing conduits at little extra cost!*

In answer to the national demand for increased copper capacities in existing conduits, United States Rubber Company has developed *new small diameter Laytex* insulated branch circuit wire* that will double present conduit capacities in commercial buildings!

What does this mean to you? Just this: the opening up of a vast commercial rewiring market with profit opportunities such as you've never seen before! Why not see your wholesaler today? Ask him about new small diameter Laytex* insulated branch circuit wire (available to all wholesalers *everywhere*)!



Conventional insulated wire, four No. 14 (code) type R conductors . . . 3450 watts.



Laytex* insulated wire, eight No. 14 Laytex* insulated conductors . . . 5800 watts.



UNITED STATES RUBBER COMPANY
Rockefeller Center, New York

Wire IS ONLY AS GOOD AS ITS INSULATION
Laytex* IS INSULATION AT ITS BEST



Now you can **PLAY SAFE**
at **LOW COST**
 Protect Even Your Light-duty Circuits with G-E Metal-clad Switchgear

G-E TYPE MI-9
 METAL-CLAD SWITCHGEAR

NINE FACTS THAT PROVE

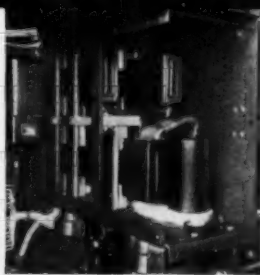
Be Sure You
 Get All These
 Advantages
 Include Them in
 Your Specifications



1. Completely Metal-enclosed—
 NO HAZARD TO PERSONNEL



2. Removable Breakers—
 EASY MAINTENANCE



3. Liberal Insulation—
 FOR SERVICE CONTINUITY



4. Co-ordinated Circuit Components—
 BALANCED DESIGN

**HIGH-QUALITY SWITCHGEAR
 FOR THE LOW-PRICE FIELD**

DRASTIC PRICE REDUCTION

on G-E Midget Metal-clad Switchgear BASED ON ANTICIPATED DEMAND



NOW you can give circuits up to 5000 volts the same dependable protection used for higher-voltage, high-capacity circuits—and at lower costs than ever before. Recent price reductions on G-E Type MI-9 metal-clad switchgear make available to

every industrial plant and public building the economy, safety, and convenience obtainable only with G-E vertical-lift metal-clad.

We have made this price reduction because we are certain that there is a wide need for this equipment in all classes of industry. The new low prices are based on anticipated quantity production of standard units. We are confident that increased sales volume will justify this price reduction.

How About YOUR Plant?

Are you sure of the protection on your incoming lines, power feeders, and motor circuits? Or are you gambling that obsolete, inadequate equipment will get by?

Are you sure that your operators are not taking

chances—on the safety of both personnel and equipment—by depending on switchgear that has not kept pace with the growing needs of industry? Many such situations are being corrected by the installation of vertical-lift, metal-clad switchgear.

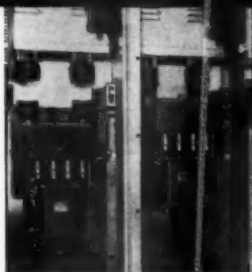
Completely Factory-assembled

Wide field service and actual operating experience in industry have proved G-E Type MI-9 metal-clad switchgear to be the ideal equipment for service up to 5000 volts, 50,000 kva interrupting capacity. It consists of a completely fabricated, factory-assembled unit, containing circuit breaker, insulated buses and connections, disconnecting devices, sturdy mechanical interlocks, and instrument transformers where required—delivered as a unit ready to put into service, with low (predictable) installed cost.

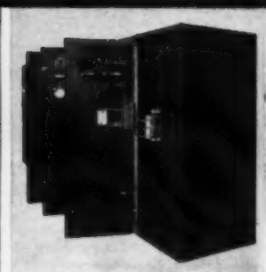
Get the complete story of this modern shipped-assembled, metal-clad switchgear. Just call the nearest G-E office, or ask for a copy of our new descriptive bulletin, GEA-2249C.



THE VALUE OF THE MI-9



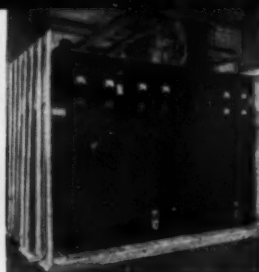
5. Sturdy Mechanical Interlocks
—SAFETY FOR OPERATORS



6. Self-contained Control—
REDUCED STATION COST



7. Not a Bunch of Boxes—
A COMPLETE JOB



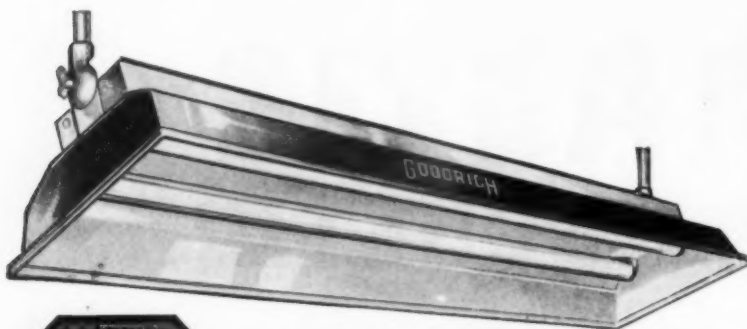
8. Shipped Assembled—
LOW INSTALLATION COST

Black
Light Bronze
Dark Bronze
Pearl Gray
Cream

9. Choice of Colors—
ATTRACTIVE APPEARANCE

GENERAL ELECTRIC

854-1



FLUORESCENT FIXTURE FOR INDUSTRIAL USE

It's new—designed for use with two 48-inch fluorescent lamps, for general and local illumination of industrial areas.

Its design, with closed ends, gives you proper shielding of lamps for better control of light. Its porcelain

enamel finish assures proper diffusion of light for illuminating both horizontal and vertical surfaces—without reflected glare. Ballast equipment corrects for power factor and flicker. The fixture is also equipped with replaceable starters.



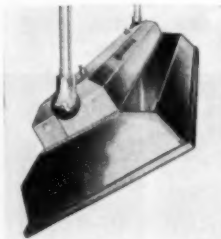
This Hinge Makes It Easy to Wire, Install and Service

Hood and reflector come apart so that wiring of reflector may be done on the bench, instead of overhead. After suspending the hood, reflector is attached by two open hinges and allowed to hang downward while line connection is made. Hood and reflector are then securely locked together with knurled thumb screws. This unique construction also provides free access for servicing.

Supplied with Adjustable Bracket for Chain or Conduit Mounting

For correct direction and distribution of light on any working plane, the reflector may be set at any desired angle by means of an adjustable bracket, furnished as standard for both chain and conduit mountings! Write for catalog sheets.

Sold only through electrical wholesalers



MEMBER OF R. L. M. STANDARDS INSTITUTE

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 2902 N. OAKLEY AVENUE, CHICAGO, ILL.



[FROM PAGE 36]

SHOWROOM LIGHTING

A unique indirect concealed lighting system has been installed at the Studebaker automobile showrooms at 56th street and Broadway, New York City. It provides 50 foot candles of smooth general illumination.

Continuous coves run in a molding, just below the ceiling, around the room



CONTINUOUS COVE indirect lighting combined with colored spotlighting help sell automobiles in this showroom.

and on each side of the center beam. They conceal small powerful X-Ray reflectors which project the light rays evenly over the ceiling, which diffuses them throughout the display room.

Recessed silver mirror X-Ray reflectors combine with strong colored floods to bathe the display windows with 100 foot candles of light that compels attention.

The used car showroom, on the second floor, is equipped with 40—500 watt indirect luminaires. The show windows have X-Ray reflectors with snap-in louvers.



GUN RANGE—The lighting on this St. Paul, Minnesota range is such that the members feel they can shoot better by night than by day. Forty-five foot candles are provided at the center of the circle from 1500-watt lamps, four per pole on each of four poles placed 30 feet apart. Ten Benjamin #7168 and six Benjamin #5592 units are used.

You Get More For Your
Lighting Dollar With
ALZAK
ALUMINUM
REFLECTORS

MADE BY:

Crouse-Hinds Co., Syracuse, N. Y.
Curtis Lighting Co., Chicago, Ill.
General Electric Co., Schenectady, N.Y.
Edwin F. Guth Co., St. Louis, Mo.
Kliegl Bros. Universal Elec. Stage
Lighting Co. Inc., New York, N.Y.
Major Equipment Co., Chicago, Ill.
Miller Company, Meriden, Conn.
S & M Lamp Co., Los Angeles, Calif.
Thomas A. Edison, Incorporated,
West Orange, N. J.
Westinghouse Electric & Manufactur-
ing Co., Cleveland, Ohio

*We do not manufacture reflectors.
The companies listed above, li-
censed under Aluminum Company
of America patents, are well able
to take care of your requirements.*



High reflectivity of Alzak Aluminum Reflec-
tors, in combination with the designs which
their manufacturers recommend, gives maxi-
mum efficiency to your lighting system. Long
life and ease of maintenance make annual
costs low.

High reflectivity is obtained by a special
electrolytic treatment of polished Aluminum
sheet. This surface is protected by a smooth,
oxide coating of glass-like hardness, to which
dirt does not cling. It won't chip, doesn't

scratch easily and can be readily cleaned by
washing with soap and water.

Alzak Reflectors cover a series of finishes.
Some are intended for indoor use. Others are
able to withstand out-of-door exposure and the
corrosive conditions encountered in certain
industrial processes. You can have bright,
specular finishes or matte, diffuse surfaces.

Whatever your use, *specify the right Alzak
finish.* Write to any of the companies listed for
further information or address your letter to us.



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ALUMINUM COMPANY OF AMERICA
1946 GULF BUILDING • PITTSBURGH, PA.

Motor Shops

FOOT CONTROL SWITCH

Many motor shops do some of their coil winding on lathes. This often requires the use of both hands and much time is lost fumbling for the start and stop control on the lathe motor.

To eliminate this Walter J. Rider, Binghamton, N. Y., uses a foot switch



FOOT CONTROL switch permits operator to focus all his attention and use both hands on the coil winding operation.

in series with the motor switch. The device is constructed of an automobile starter switch and a cast hinged pedal. A pressure of the foot on the normally open starter switch closes the circuit and starts the motor. When the pressure is released the circuit opens and the motor stops. Thus all the winder's attention can be focussed on the coil winding operation.

HANDY CHISEL

John H. Kutz of Reading, Pa., found out that "necessity is the mother of invention." While installing an additional outlet in a finished house he encountered a quantity of tough plaster behind the lath. This had to be removed to fish the cable through. But he discovered that a straight chisel

marred the baseboard. So he took a 15 inch piece of $\frac{1}{4}$ -in. by 1-in. flat iron, heated it, bent the end and flayed and sharpened the tip.

With this offset chisel he was able to finish the job without damaging the baseboard. And it works well on other jobs and saves plenty of time. A handy tool to have around according to Mr. Kutz.

TEST TRANSFORMER

T. L. Rosenberg Co., of Oakland, California, has a portable test transformer which is used in the motor repair department. The unit is mounted on a platform



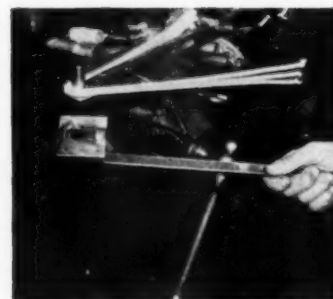
TEST TRANSFORMER mounted on a portable platform eliminates necessity of moving heavy equipment to test position. A small hand unit is in foreground

equipped with casters, and has long leads. The unit can be rolled to the equipment, instead of maneuvering heavy equipment to a test position. Voltages up to 2000 volts can be taken from taps on the transformer, and at any current desired.

COIL BENDER

The Nason Electric Service of Newark, N. J., made this coil bending tool to form hairpin bends in coils made of multiple turns of rectangular cotton covered copper.

The unit consists of three parts. A long base has two guide rails forming a groove



HAIRPIN BENDS are made in rectangular copper coils with this handy and simple bending device.

the width of the copper and, in this particular case, deep enough to hold three parallel lengths of copper. One guide rail is directly behind the bolt around which the copper is bent, permitting a full 180 degree bend.

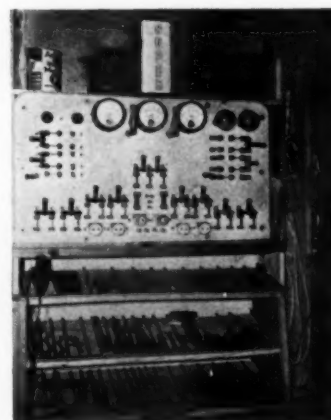
The second part is the forming head made of a machined steel block carefully drilled to fit snugly over the bolt and containing a smaller block which bends the copper around the bolt. The small block is of the same thickness as the guide rails and the distance from the edge of the bolt to the inner edge of the block is ample to permit a smooth uniform bend.

The third part is the bolt around which the copper is bent. It holds the forming head snugly against the guide rails.

The tool proved invaluable in making the hairpin bends for the nose of the coils before they were spread. It makes a smooth uniform accurate bend without cracking the copper or damaging the cotton insulation. It was used for making the coils for rewinding the rotor of a large rotary converter.

TEST BOARD AND TOOL RACK

The small shop adjoining the office of the Solliday Electric Shop, Allentown, Pa.,



RECESSED SHELVES for tools, under compact testboard, prove to be an important time saver in this small shop.

Electrical Contracting, April 1940

ARROW LOCK SWITCHES

Keep the lighting control in safe hands



Upper illustration: Standard Flush type; No. 1281 Switch with No. 1285 Plate.

Lower illustration: Outdoor Weatherproof type with screw-on cover; No. 1281-WP.

ROTARY TYPE with P. & F. CORBIN Pin Tumbler Locks

These switches stand for PROTECTION on the one hand and ECONOMY on the other.

Protection against the danger, say, of throwing into darkness a room full of people. Economy in preventing waste of current thru turning lights ON in a place *empty* of people.

The Corbin Pin Tumbler Locks securely bar "fooling with the lights." In theatres, auditoriums, schools, hospitals, institutions, these tamper-proof switches need no other recommendation than their obvious insurance-value against trouble and loss.

Not only is responsible control assured by the fool-proof locks, but *dependable* control is assured by the trouble-free mechanisms — mechanically and electrically perfected by a half-century of fine switchmaking.

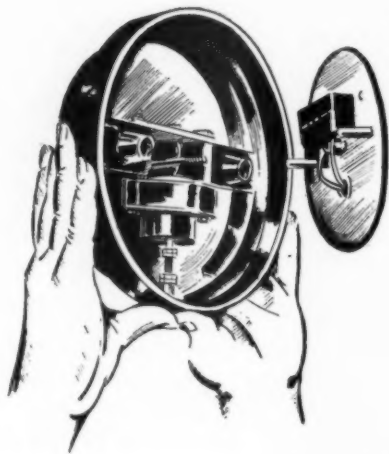
These are not ordinary switches with a locking device, but are time-tested Rotary Snap Switches operated only by *turning key* in the integrally-designed Corbin lock. Available also with newly developed Master Key system. See complete listing of enlarged line on Page 35 of Catalog.



SOLD THROUGH YOUR

ARROW ELECTRIC DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

ELECTRICAL WHOLESALER



*So we designed a new KIND of bell**

BUGS and moisture frequently play havoc with electric bell mechanisms . . . sometimes endanger life and property by causing crucial-moment failures of alarm systems.

Applying Connecticut's advanced engineering policy to this problem, we soon found the answer — the new **CONNECTABELL**. As an example of "a modern improvement," this new alarm bell is, in itself, worthy of serious consideration.

But — as an example of alert, progressive engineering, it becomes a symbol of the kind of thinking you can expect — and get — when you ask Connecticut to go to work on a signaling or communications job.

Whether you are planning a simple or an elaborate system, let our free Advisory Planning Service work it out for you. It costs you nothing, from preliminary layout to detailed riser diagrams . . . will save you money on the installation.

***CONNECTABELL** is an entirely new KIND of alarm and signal bell. Using Alnico — the recently discovered, most powerful magnet metal—it has a new type of sealed construction which protects it against insects and moisture; not even air can reach the windings. Wear is elimin-

ated — the only moving unit is the striking plunger.

Modern to the last detail, it is designed to install quickly, easily, on any standard outlet box, surface or flush. Whether building or modernizing, install **CONNECTABELL** for the safest, most dependable, economical alarm or signal system.

*For advanced engineering
put it up to "Connecticut"*

CONNECTICUT TELEPHONE & ELECTRIC CORPORATION
Meriden, Connecticut
COMMUNICATIONS AND SIGNALING SYSTEMS



[FROM PAGE 42]

is a mechanic's paradise. Everything is in full view and within easy reach. No necessity to walk about or open drawers for tools to use in repairing the appliances or motors that come into his shop.

The tool shelves are recessed in the wall directly below the test board. Each shelf is subdivided by a small molding, making convenient compartments for the various tools. When a compartment is empty Mr. Solliday knows at a glance what is missing and begins checking up. A visual inventory of the tools can be quickly made at all times.

A mechanic, becoming accustomed to the system, can get a tool without looking up. Lost motion is practically eliminated. And that's vital in the small repair business.

The test board contains every device that is necessary for testing small equipment, even a buzzer-lamp combination for testing bells and chimes as well as appliances.

JUNK WIRE DISPOSAL

Any motor shop man who walks into the stripping room at the Chicago Electric Company in Chicago will immediately feel that something is missing. There are no boxes or bins or piles of accumulated junk copper.

It is all done with a trap door. A small section of the floor at one corner of the room lifts up to provide access to a junk wire bin below. Strippings can be disposed of in a few seconds keeping the stripping room clear.

Brick walls and a boiler plate steel floor provides an entirely fireproof room. Stator windings are stripped with a torch.



JUNK WIRE is cleared out of the stripping room through a trap door leading into a bin below.

EASY TO SELL—"Call Backs" Saves —EASY TO INSTALL

Ask Us Another

What contact material is used in small G-E manual and magnetic starters?

Fine silver, which is 99.9% pure silver, is used. Oxides form slowly on this material; if oxides form, they are reduced to pure silver and returned to face of contact by heat due to current flow. This means maximum tip life without filing.

What advantages has a toggle-operated manual switch over one that is push-button operated?

The toggle operation indicates to operator that he is using a manual control which does not protect him against restarting in case of power failure.

Are G-E manual starters available for dusty, wet, or hazardous locations?

Yes. Dust-tight and water-tight enclosures, as well as Class I, Group D listed by the Underwriters are available for both these starters.

G-E

MANUAL STARTERS

These features
eliminate
"call backs"



of
as you
proximity
the point of
lowest economy



JONES ELECTRIC CO.
12154 MADISON ST.
CINCINNATI, O. 7.

Repair defective
motor starter .30
6 hours labor .83
Repair parts .25
Telephone charge
Truck tied up
Overhead?
Service No Charge
H

Every time you "call back" after completing a job you're eating up profits. A workman's time is lost. And even more important than wasted time, you may be losing customer good will and confidence.

One good way to stop such waste is to install only motor-control devices you can depend on. G-E controls like those shown above and described on the next page will save you time and make your jobs more profitable.

Easy to See Why

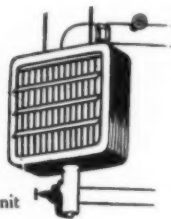
YOU'LL SAVE COSTLY "CALL-BACKS" WITH G-E MANUAL STARTERS

Where to Use G-E MANUAL STARTERS

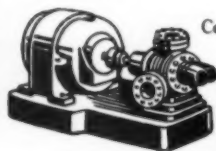
Rule: A manual starter is suitable any place where a small motor can be hand controlled from a single point nearby.



Small-hp machines or grinders



Ventilating fans or unit heaters

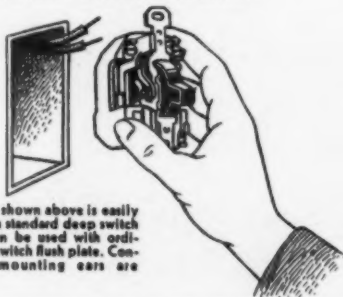


Coolant pumps

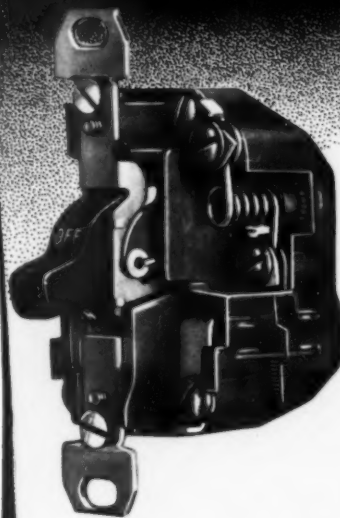


Job presses, bindery equipment, etc.

INSTALLATION NOTE



The CR1061 shown above is easily installed in a standard deep switch box, and can be used with ordinary toggle-switch flush plate. Conventional mounting ears are provided.



CR1061 for Motors to 3/4 Hp

Switch element, removed from case, suitable for fitting into standard deep switch box.

Overload heater, selected to suit motor to be protected, easily installed on switch.

Solder-film-type overload device protects motor against serious overheating.

Trip-free mechanism cannot be held closed during excessive overload.

Simple quick-make, quick-break, snap-action toggle mechanism assures maximum contact life.

Arcing chamber encloses long-lived, double-break, fine-silver contacts—minimizes arcing and provides high interrupting capacity.

Large terminal screws facilitate making good connection.

CR1062 for Motors to 7 1/2 Hp

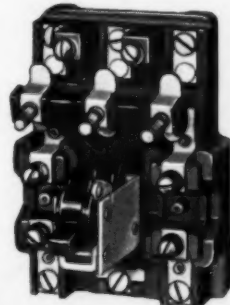
This switch element removed from its enclosure is typical of manual starters rated 7 1/2 hp at 440 volts.

Convenient terminals at top and bottom for line and load connection.

Fine-silver contacts, separated by arc barriers, provide high interrupting capacity and long life.

Operated by sturdy handle of molded Textolite.

Thermal overload device protects motor against serious overheating. Replaceable heater is selected to suit motor.



Fortify yourself against "call-backs" due to starter or motor trouble by using G-E starters. They are so widely accepted that they're sure to please your customers. And they're easy to install, too—will save you time on the job.

There is a G-E distributor near you with a complete stock of these manual starters—and the entire line of G-E control. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

676-6

MATERIALS HANDLING

MODERN industry is vitally interested in reducing production costs. To this end, industrial progress today depends more and more on the perfection of mass production methods—producing more units at less cost. And closely integrated in this system is the efficient handling of materials, for processing, assembly and shipping. The old method of using man power to transport material from one point to another has been replaced by modern mechanized units which require only the pressing of a button to do the job.

The devices employed cover a wide variety of conveyors, cranes and hoists. And the maintenance man of today, being an important cog in plant operation, should have a general knowledge of this type of equipment, and should know when, where and how to use it. And he must also know where to look for trouble and what to do about it, when a unit fails to function properly. For an interruption in service may have serious consequences.

Therefore, the Maintenance Guide Sheets this month cover a general discussion of the application and maintenance of conveyors, cranes and hoists. Previous articles covered:

1. Alternating Current Motors
 2. Direct Current Motors
 3. Alternating Current Motors—Maintenance
 4. Direct Current Motors—Maintenance
 5. A.C. Motor Starters and Controllers
 6. D.C. Motor Starters and Controllers
 7. Maintenance of Control Equipment
 8. Special Control Problems
 9. Electric Distribution
 10. Lighting
 11. Electric Heat
 12. Electric Welding
 13. Interplant Communication
 14. Instruments
 15. Power Tools
 16. Batteries and Rectifiers
 17. Electroplating
 18. Electronic Devices
 19. Circuit Breakers
 20. Equipment for Hazardous Locations
 21. Transformers
 22. Wiring Devices and Fittings
 23. Wire and Cable
 24. Belts and Pulleys
 25. Couplings, Gears and Chains
 26. Elevators, and Industrial Trucks
 27. Conveyors, Cranes and Hoists (this issue)
- Coming articles will discuss
28. Ventilating and Air Conditioning Equipment
 29. Management of Maintenance

ELECTRICAL Maintenance

CONVEYORS, CRANES AND HOISTS

Types and Maintenance

MATERIALS handling in industrial plants and warehouses involves the use of conveyors, hoists and cranes. Therefore, for the electrical maintenance, this quick review of these equipments presents the various types in general use and recommendations on how to keep them in working condition.

Conveyors

Primary object and purpose of conveyors is to convey materials either horizontally, vertically or a combination of both. They facilitate the handling of materials smoothly, rapidly and at a predetermined rate.

Conveyors most commonly used are:

1. *Belt conveyors* which are especially adapted to convey bulk materials such as coal, coke, sand and chemicals at high capacity due to continuous delivery.
2. *Screw conveyors* which are especially adapted to convey grain, cement, pulverized coal, sand and other bulk materials. The conveyor discharges at an end opening or through openings in the bottom of the trough in which the screw revolves.
3. *Bucket conveyors* which are adapted for elevating bulk materials such as coal, ashes, sand and stone, either vertically or inclined.
4. *Flight conveyors* which are adapted for conveying nonabrasive materials, and are used extensively as distributing conveyors for filling bins

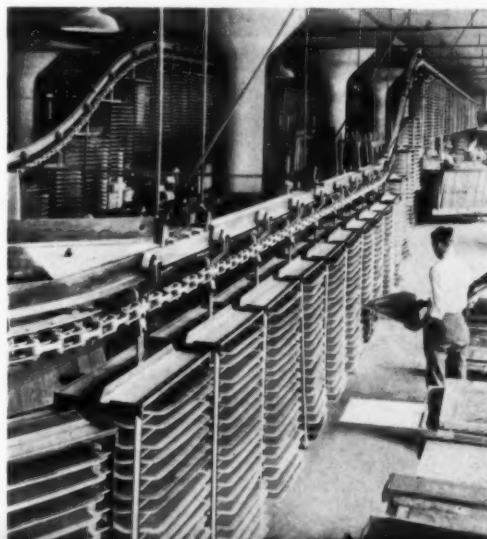
as well as general all-around service to distribute bulk materials.

5. *Package conveyors* which are adapted to handle materials such as bags, barrels, baskets, boxes, crated parts and mail sacks.

6. *Pivoted bucket carriers* which have buckets that maintain their carrying position by gravity; hence a single carrier can transport material horizontally, vertically and again horizontally, or in any desired path, within a vertical plane of travel.

7. *Trolley conveyors* which are flexible overhead mediums for handling individual articles, or material in containers. The conveyor is inexpensive

TROLLEY CONVEYOR at American Seating Co., Grand Rapids, Mich. "circulates" suspended racks, each holding 18 signs, around the room until the signs are dry. (Link-Belt Co. photo)





AT FLOOR LEVEL—Wood-apron conveyor is used in handling extra heavy barrels on loading platforms of a Mid-western lead company. Speed 50 ft. per min. Capacity depends on the operator. (Jeffrey Mfg. Co. photo)

to install and is economical of space, power and maintenance expense.

8. *Portable conveyors* are used to convey material between two production machines, and to load and unload hoppers, trucks, railroad cars and vessels.

Trippers are used with belt conveyors where uniform and wider distribution of material is desired.

Magnetic pulleys or separators are used with conveyors when magnetic material must be removed. The pulley usually displaces the head pulley on a belt conveyor. Its size and diameter are usually determined by the capacity handled, the speed of the conveyor, and the depth of the material; maximum speed is usually 38 r.p.m.

Five important points are to be considered in selecting conveyors; all have a bearing on the electrical equipment. They are:

1. Material handled—free-flowing, sluggish, abrasive, nonabrasive; this is important as to whether open or enclosed motors should be used.

2. Type of conveyor; this determines the characteristics of the motor.

3. Capacity; this will have a direct bearing on size, rating, and speed of motor.

4. Atmosphere—dry, dusty, damp, gaseous—in which the conveyor and motor must operate; this determines whether open, semi-enclosed, totally enclosed, totally enclosed fan-cooled, or explosion-proof motor should be used.

5. Conditions for outdoor operation; this determines whether a splash-proof

or totally enclosed fan-cooled motor should be used.

Control should have enclosures that will be suitable for the conditions encountered for the motor.

Squirrel-cage motors rated up to and including 5 hp. should be normal-torque, normal-starting-current type; motors rated 7½ hp. and over should be normal-torque, low-starting-current type.

Wound-rotor motors or preferably high-slip, high-torque squirrel-cage motors should be used where a definite cycle, including frequent starting and stopping is necessary, as on package conveyors and tray elevators.

Compound-wound motors are usually used where d.c. power is supplied. However, shunt-wound motors because of their constant-speed characteristics are used where a conveyor is to cover a specified distance in a predetermined time, as on enameling and japanning ovens.

Starters should be the magnetic type, push button operated, providing overload and undervoltage protection. Push buttons of only the momentary contact type should be used so as to obtain undervoltage protection. For a.c. motors, starters should be across-the-line type; for d.c. motors, they should have starting resistors.

Location for the starters is optional. However, it is good practice to locate each starter in close proximity to the respective motor; for testing and trouble-shooting purposes, this arrangement simplifies matters.

Main control buttons for any conveyor or sequence of conveyors should be marked "start-stop" and should be located at the receiving end. At intermediate points along the conveyors, "safe" and "stop" push buttons should be located for convenient access.

Where two or more conveyors are operated in sequence, their control circuits should be interlocked so that when the control button closes the circuit of the last conveyor, each conveyor is energized in proper sequence until the first or feeding conveyor is energized.

The various overload relays should be connected in their individual control circuits. Then if any conveyor stops due to an overload, the feeding conveyors will also stop but the succeeding conveyors will continue to clean out.

Photoelectric cells are used for counting articles which pass a given point. They can also be used for synchronizing two conveyors where actual electrical contact or mechanical connections are impractical. They cannot be used in dusty atmospheres unless thoroughly shielded.

Solenoid, motor operated, or disk type electrical brakes are employed to

advantage when conveyors are used to distribute material at definite points within close limitations. Either an electrically or manually operated brake is used on inclined conveyors and elevators to prevent overhauling in case of power failure, or when it becomes necessary to stop the fully loaded conveying medium.

The type of mechanical power transmission depends on space and speed in feet per minute of transmission. The motorized speed reducer usually employs an 1,800-r.p.m. motor, and lends itself to direct connection by a coupling or to driving the conveyor either through a silent or roller chain, thus assuring a positive drive. Belts should be used only where resilience is required and where positiveness of drive can be sacrificed.

Where materials are to be conveyed at various rates a multi-speed squirrel-cage motor or an adjustable-speed d.c. motor may be used. Another method is to use a variable-speed transmission unit between the conveyor and motor. These units are available in various ratios, horsepower ratings and styles.

Important points on the maintenance of conveyors and the electrical equipment are listed in the accompanying Maintenance Guide Chart.

Cranes and Hoists

The two general classes of electric hoists and cranes are: the first and more popular type covering a capacity range under five tons, and the second classification covering large traveling cranes ranging in capacity up to 300 tons.

This discussion will deal more specifically with the smaller classification inasmuch as the large equipment involves such a wide variety of mechan-

STEEL RODS being handled by a five-ton bridge crane with trolley and cage control. (Harnischfeger Corp. photo)



MAINTENANCE GUIDE CHART

Maintaining Conveyors

1. Once a month, or more often depending on operating conditions, inspect all electrical equipment.
2. Tighten loose connections, at motor terminals, controllers, and push buttons.
3. Remove dust from motors and controllers, by blowing out with low-pressure compressed air.
4. Check, smooth, and adjust contacts on magnetic control and line switches. Replace contacts that have worn to a point where contact pressure is reduced below a safe value, to prevent welding or "freezing."
5. Inspect overload relays, fuses and fuse connections. See that fuses have the proper rating.
6. See that all equipment has good ground connections.
7. Check alignment of coupling, pinions, and pulleys.
8. If motor overheats, make tests for load, voltage, ground, poor connections, and check for rotor rubbing on the stator.
9. Grease and oil all mechanical parts, according to manufacturer's specifications. Where worm or gear reducers are used, oil should correspond to that indicated on the nameplate of the unit.
10. Maintain oil level on all reducing and variable speed devices. Oil-level gauges are furnished for this purpose.
11. Carefully lubricate anti-friction bearings, to prevent operation under pressure because excessive lubrication will tend to cause sluggishness between balls or rollers and races.
12. While all other moving parts should be inspected and lubricated once a week, anti-friction bearings should be cleaned twice a year and repacked with the correct amount of grease.
13. Detect any undue friction developing by making periodical power tests, always under similar conditions. Any variation in results obtained should be followed immediately by inspection.
14. Carry in stock contact fingers, contacts, magnet coils, overload heater strips, bearings, and possibly a complete stator or armature if there are enough duplicate motors to warrant stocking the parts. In fact, where enough duplicate motors and starters are being operated, a complete motor and starter should be included in the spare part stock.
15. Carefully file and index all records for a particular conveyor. Dimension sheets and wiring diagrams are valuable in clearing up trouble.

Maintaining Electric Hoists and Cranes

1. At least once a month inspect entire electrical system of each equipment.
2. See that hoist is properly grounded to I-beam or other supporting mechanism.
3. Be sure that push button station is grounded, particularly on 440-volt systems. Also see that push button cords have not been damaged so as to expose a live wire to the operator.
4. Where push button wires are continually exposed to oil and grease, use an insulation such as neoprene instead of standard rubber. The extra cost of this insulation is well worth the protection given.
5. Install line cut-off switch fuses so that current may be cut off in the event of an accident. A faster line switch may be of the usual knife type.
6. Regularly inspect current conductors to see that the supports are tight and in line with the current collectors. A loose bolt on a commutator bar would allow the line wire to drop, probably on a workman, with serious results.
7. Check limit switches on hoist, trolley and runway to see that they function properly, and thus avoid running through a stop.
8. Inspect contact points on the control equipment to prevent sticking and to determine whether they require replacement.
9. On magnetic-operated contactors reduce roughness of contacts; however, where an accident or short circuit has occurred filling may be necessary.
10. On manually operated control, either of the drum or face-plate type, occasionally smooth off contact tips with a file, to insure good electrical contact.
11. Clean motors by blowing out with compressed air, to remove dust from windings, brushes and commutator.
12. On d.c. motors check brushes, to avoid damaging the commutator.
13. See that connections are tight and that wires have not been chafed or injured.
14. Check level of lubricating oil in gear housing. On most hoists, if all seals are tight, it should not be necessary to replace lubricant more than twice a year. But on a new hoist it is possible leakage may require more frequent filling, or that the seals need to be checked.
15. Occasionally adjust load brake, whether of the solenoid-operated type or the manually operated type, to insure proper brake action.
16. Lubricate controller linkage of safety limit switch stop paddles, with machine oil to insure free operation and to prevent rust.
17. Occasionally lubricate lifting wire rope, with a special lubricant intended for the purpose.
18. Inspect wire rope for broken wires, and replace the rope when there are more than six broken wires per foot of cable.



IN A TANNERY—Twin-hook hoist is used to remove hides from vats. (Yale and Towne Mfg. Co. photo)

ism from the electrical standpoint as to require detailed treatment on each individual type.

According to application, the types of electric hoists are:

1. Straight electric hoist mounted rigidly to an overhead structure or supported on a hook.
2. Electric hoist mounted on a push trolley or a geared trolley operating on an I-beam or other overhead rail.
3. Built-in electric hoist mounted on a motor-driven trolley so that the load may be lifted and transported.
4. Electric hoist or electric winch mounted on a jib crane to service an individual machine.
5. Electric hoist with either hand-operated or motor-driven trolley mounted on an overhead traveling crane for servicing an entire floor area.

Load capacity—On account of the hazards involved cranes and hoists should have sufficient capacity to avoid overloading. On some applications of hoists it will be found that the load is bound to stick to some fixed object. For such operations the hoist must be larger in capacity than the load lifted.

Duty cycle—On the average hoist application the duty cycle is such that a standard hoist with a standard motor will have sufficient capacity to avoid overloading. This classification will probably involve no greater than 25 lifts per hour. Such a cycle allows a sufficient rest period between lifts to allow the motor to cool.

Where the duty cycle is extreme, such as in production lines, it is important to indicate to the hoist manufacturer the exact duty cycle involved, such as 60 lifts per hour with full load over a 5-ft. distance.

Atmospheric conditions—High room temperature, moisture and acid fumes,

etc., must be given consideration, so that the electrical equipment can be designed to meet the conditions.

Type of current—With the modern development of hoist motors and control either a.c. and d.c. equipment may be used. Variable-speed, high-torque a.c. motors are available, which give just as high a degree of control as with d.c. motors. It is no longer necessary to install motor-generator sets to obtain direct current for hoist equipment.

An a.c. control equipment will usually give longer life than is possible with d.c. control. However when a hoist installation is contemplated, consideration should be given to the hoist application, type of power to be used, and speed regulation of the motor.

To move loads over a considerable distance it is usually economical to employ an electric hoist with a motor-driven trolley, so that the operator may walk a safe distance from the load while it is being electrically transported. In cases where high tonnage per hour must be transported, a motor trolley hoist with cab control allows still greater production per man and still greater safety of operation.

Close-headroom hoists provide a maximum lift in plants having low ceilings or where the load must be lifted close to the overhead structure. In general, the standard normal-headroom hoist using only two ropes instead of four is usually more desirable from a cost and maintenance standpoint, on hoists of less than 5-ton capacity.

On hand trolley-mounted electric hoists it is convenient to have an electric cable leading from the hoist, and arranged for plugging into power outlets on the wall or on columns. Where the hanging electric cable interferes with the hoist operation, power is supplied by trolley wires mounted on the I-beam, with current collectors on the hoist. Current collectors are either the shoe or wheel types.

Overhead trolley wires should be accurately spaced to avoid undue action in the spring follow-up of the current collectors. Commutator bars should be kept a fixed distance above the bottom of the I-beam, to reduce to a minimum the up and down motion of the current collector. In addition they should be kept to a fixed distance from the centerline of the I-beam to reduce side motion of the current collectors.

While current collectors are capable of considerable self-adjustment both vertically and horizontally, it is highly important from a safety and maintenance angle to take every precaution to avoid the current collector jumping off the commutator bars.

A cut-off switch and line fuse should

be installed ahead of the commutator bars, to give protection against accidental short circuits.

Where there is a possibility of commutator bars being touched by workmen, a shielded construction is recommended. Equipment for enclosing the current carrying wires is available, and while it is more costly in installation, the protection it gives is well worth the added expense.

Power requirements of a hoist may be determined when the load and speed specifications are known. Motor horsepower can be computed by multiplying the load in pounds by the speed in feet per minute and dividing by 28,000. Using the factor of 28,000 instead of 33,000 allows an efficiency of 85 per cent for the hoist itself.

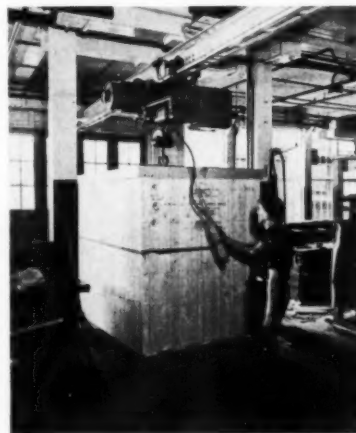
Fully enclosed motors are usually employed on hoists because they offer protection against dust and moisture. However, where lifts are extremely long, open motors are sometimes used.

Usual practice in the hoist industry is to furnish motors having a 30-min. rating. This means that the motor is capable of developing its full horsepower for 30 minutes out of an hour, without undue heating.

For the large traveling cranes, d.c. motors are usually the series-wound enclosed type, and a.c. motors are the enclosed wound-rotor induction type; both are used because of their high torque characteristics. Other electrical equipment on cranes includes brakes, drum type switches, magnetic control for speed regulating and dynamic breaking, crane protective panels, limit switches, cable and cable reel for magnets.

For the care of cranes and hoists, a series of check points are listed in the Maintenance Guide Chart.

SERVING crating department and loading platform, this hoist is a two-motor close-clearance, five-speed push button control. (Shepard Niles photo)





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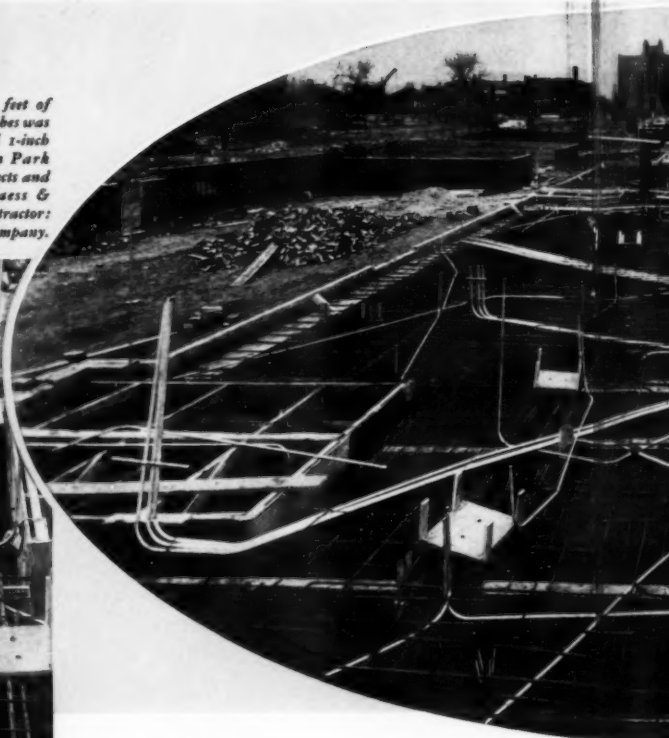
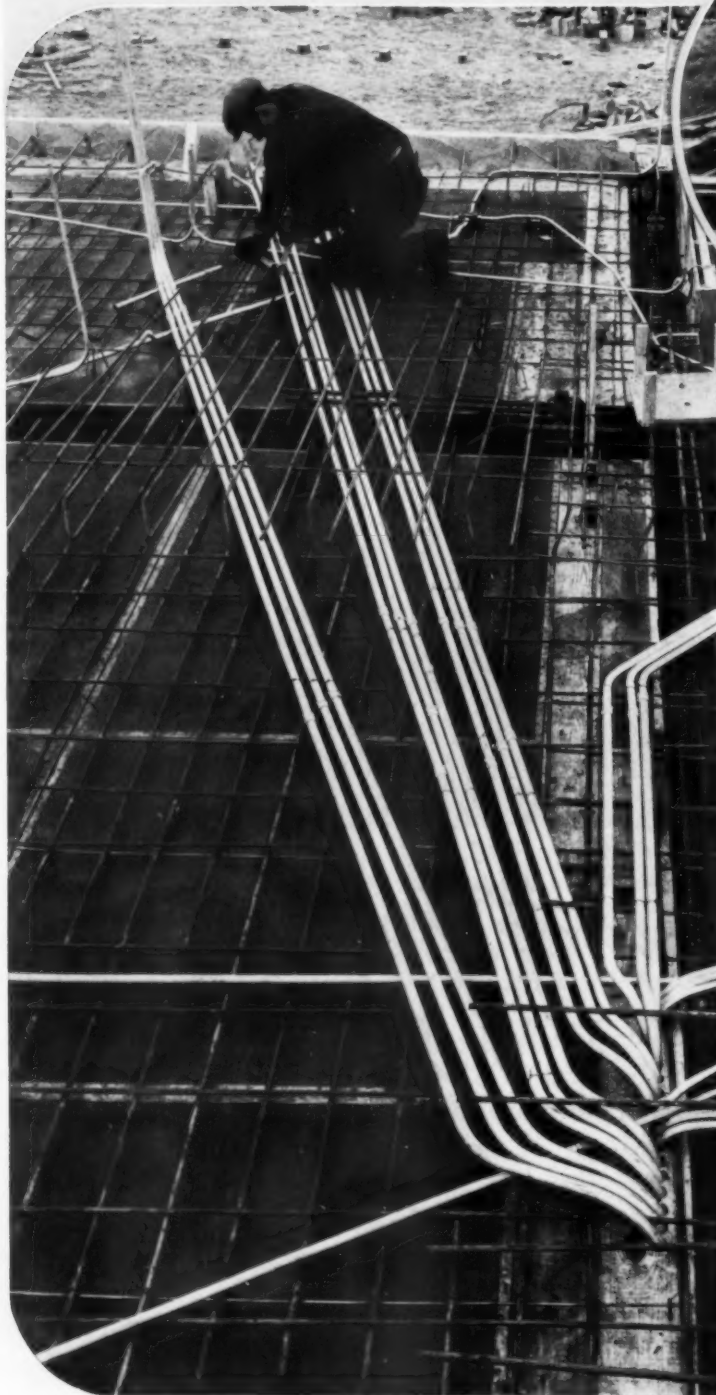
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Approximately 250,000 feet of ELECTRUNITE Steeltubes was required in ½, ¾ and 1-inch sizes for the Chatham Park Housing Project. Architects and Engineers: Shaw, Naess & Murphy. Electrical Contractor: Ernest Freeman and Company.

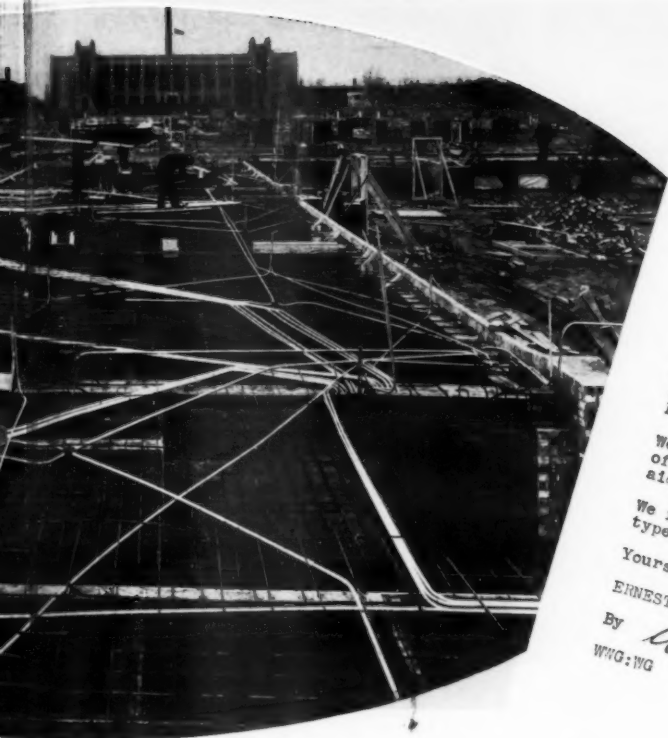


New Chatham housing project **STEELTUB**

● Again, ELECTRUNITE Steeltubes—the modern raceway for wiring—has been used in an outstanding concrete job—the new Chatham Park Housing project in Chicago, Ill. For years to come, the wiring in these buildings will be safe behind sturdy walls of steel.

But that is only half of the story. The other half is the happy experience of the electrical contractor. Having used ELECTRUNITE Steeltubes on previous contracts, he knew that it is easy to handle, install and wire. He felt sure

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 By *W. GiesSEN*
 WWG:WG

December 22, 1939

Chatham Park Project wired in 250,000 feet of TUBES IN CONCRETE!

that his estimated cost would check and that the job would move on schedule. He knew that his workmen liked to use this easy-to-work raceway. And, again, results proved to him that this improved electrical metallic tubing is the ideal raceway for concrete work.

Use ELECTRUNITES Steeltubes on your next job, in concrete or exposed—that's the best way to learn what it can do for you. Steel and Tubes Division, Republic Steel Corporation, Cleveland, Ohio.



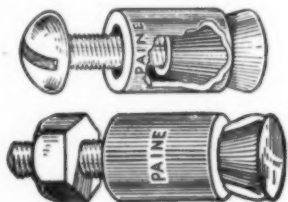
Look for this label. It is found only on genuine ELECTRUNITES Steeltubes.

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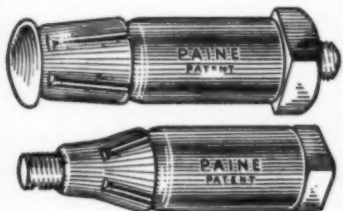
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To insure dependable, permanently secure anchorage in all walls, floors or materials standardize on PAINE ANCHORS. Improved design built on extensive tests under all working conditions, give PAINE ANCHORS far greater holding strength—a wide safety factor you can rely on.



PAINE LEAD ANCHORS. These are the safest anchors for fragile materials, yet are equally effective in brick, stone, marble, etc. Their ease and simplicity of installation and permanent dependability save far more than the original cost. Embodying strong rustless cone and a specially developed lead-mix, they have by test as much as three times the holding strength of anchors of similar appearance.



PAINE STEEL EXPANSION ANCHORS fasten anything securely in concrete, brick, tile, slate, marble and stone.

Having the largest gripping area of any expansion anchor, they hold firmly to the hole walls making them equally effective in bottomless or exact depth holes. May be used repeatedly with same security by bending jaws back to original position.

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Capacitors Help Reduce Power Costs

An installation of capacitors to improve power factor, permitted power to be purchased on a kva. demand basis. This reduced the cost of power for the Union Central Life Insurance Co's Building, Cincinnati, Ohio.

W. C. Winall, Chief Electrician, found that low power factor was caused by light loads on the elevator motor-generator sets. The building has 18 passenger elevators, each operated by a variable voltage d.c. motor. The d.c. power is supplied from a total of 18 motor-generator sets. The m-g sets are operated from 208-volt, 3-phase, 60-cycle central station service.

Each elevator has an individual m-g set. Ten high-rise elevators are operated from ten m-g sets, each rated 58 hp. a.c. input. Eight low-rise elevators are operated from eight m-g sets, each rated 35 hp. a.c. input.

Here was the problem. Overall power factor was 82 per cent because the average power factor on the m-g sets varied from 31 to 58 per cent, integrated on 15-min. interval. The local utility offered an optional rate with

the demand charge on a kva. basis. If power factor could be raised to approximately 95 per cent, a substantial saving could be effected by the optional rate. Tests indicated that 200 kva. in capacitors at 208 volts was required to raise the power factor to 95 per cent.

Mr. Winall installed 25 capacitors, each rated 10 kva. at 230 volts or 8.15 kva. at 208 volts. The installation included two capacitors per m-g set for four high-rise elevators, nine capacitors for all m-g sets on the other six high-rise elevators, and one capacitor per m-g set for the eight low-rise elevators.

The capacitors were mounted on the "hot" side of the starting panels, so as to be connected in circuit continuously. They are disconnected from circuit only when the main switch of each elevator is opened. The capacitors are a product of Cornell-Dubilier Co., South Plainfield, N. J.

After these capacitors were installed, voltage at the main bus was 218 volts on a 208-volt network system. Increased voltage automatically improved power factor at the m-g sets. The overall power factor was increased from an estimated 95 per cent to over 97 per cent.

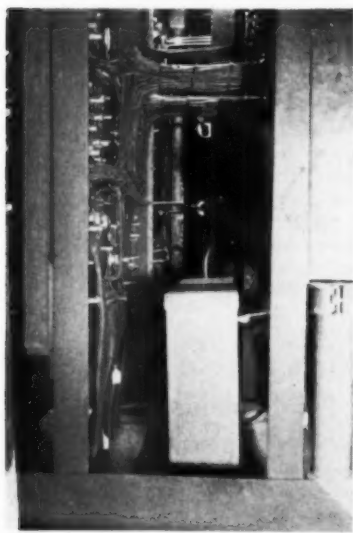
From the financial standpoint—cost



IMPROVED LIGHTING in the fabricating shop of the Chicago Bridge and Iron Company, Birmingham, materially increased production during the night shift. High-bay lighting units with 1,000-watt mazda lamps produce an average light intensity of 11 foot-candles on the working areas. The units are mounted 55 ft. above the floor and spaced at 26-ft. centers.



W. C. WINALL, Chief Electrician, was telling about mounting the capacitors on the rear of motor panels.



UTILIZED SPACE—Other capacitors were placed between frames of motor panels and required no mounting.

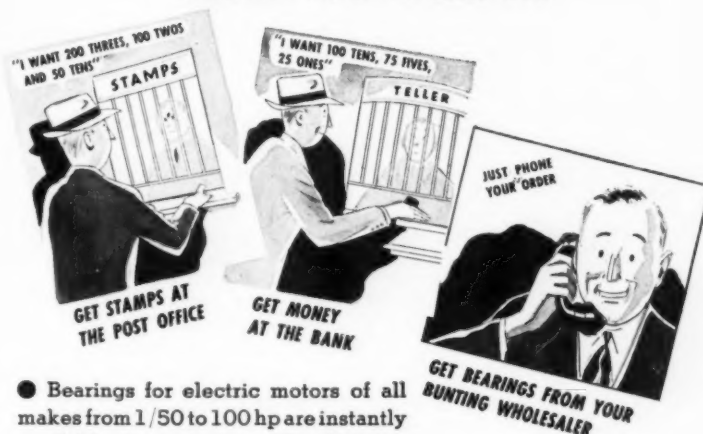
of installation, capacitors plus labor, was a little less than \$4,700. Savings in power costs were approximately \$2,000 per year. On this basis, the installation pays for itself in about 2½ years.

Mr. Winall reports that the capacitors are doing everything that was expected of them. The management is well pleased with the savings.

Industrial Vacuum Cleaner Saves

When it is time to clean electrical equipment, an industrial vacuum cleaner is a handy tool. Dust and dirt is col-

WHERE YOU GET WHAT YOU WANT When You Want it!



● Bearings for electric motors of all makes from 1/50 to 100 hp are instantly available from stock . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

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"We find there is a saving in the price of material, ease and simplicity of installation, as there are no tools required except a BRIEGEL Indenter."

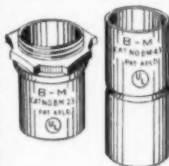
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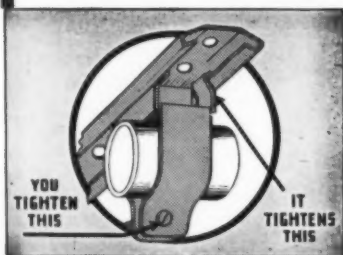
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Sleeve BEARING HEADQUARTERS
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A.C. CIRCUIT ANALYZER

15 Meters in
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WATTS: 0-20-
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Uniform watt-
meter scale.

CURRENT: 0-
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Also tests electrical appliances from clocks to cooking ranges operating on the three wire Edison Circuit. All necessary leads and connectors available.

This is just one of the many types of Hickok built electro-dynamometer watt-meters.

Write for Bulletin 900.

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MOTOR CLEANING TIME—The job is easier and cleaner when dust is collected by an industrial vacuum cleaner

lected from machines, pipes and floor instead of being "blown" into the air to settle again on the equipment.

C. L. Shaffer, Superintendent of Maintenance, O. M. Edwards Company, Syracuse, N. Y., reports that industrial vacuum cleaners make cleaning jobs easy. He has used them for over two years and saved his firm many dollars. In addition the machines are used to remove metal chips and other particles from floors, and soot from the tops of boilers and pipes.

Gauge Speeds Checking of Fillet Welds

Welding operators and inspectors can quickly and accurately check the size of fillet welds by a new gauge which has recently been developed by General Electric Co. The device, which slides readily into a shirt or trouser pocket, consists of three stainless-steel stampings held together by a bolt and a knurled thumb nut.

Either convex, concave or standard fillets can be checked merely by fitting the edge of the gauge flush against the work so that the indicating portion of the gauge rests on the weld bead.

The gauge can be used on fillets of the following sizes: 1/4-in., 3/8-in., 1/2-in., 5/8-in., 3/4-in., and 7/8-in. These sizes are marked in black on the gauge.

\$500 Capacitor Pays in 11 Months

Power factor was 70 per cent in a soybean processing plant at Toledo, Ohio. Electric energy was purchased under a primary rate schedule provid-

ing for a penalty when the power factor is below 75 per cent, and a bonus when the power factor is above 85 per cent.

The possibility of taking advantage of the bonus feature was brought to the attention of the plant management. After considering the plant equipment and operating conditions, a 60-kva. capacitor was installed to correct the power factor to 95 per cent. The equipment was purchased for approximately \$500.

Since the capacitor was installed, the power factor has averaged 95 per cent, and the monthly power bills have been reduced an average of \$45. On this basis, the annual saving amounts to \$540, or a return of 108 per cent on the investment. Thus the capacitor installation pays for itself in eleven months.

For a Flat-Belt Drive

Some points of general practice on the layout of a flat-belt drive are:

Use a belt speed between 2,000- and 4,000-ft. per min. and not over 5,000-ft. per min.; as speed increases centrifugal tension reduces belt capacity.

Keep the ratio of pulley diameters under 5:1.

Refer to manufacturer's table for correction factor for arc of contact.

Unless specially arranged for a short-center drive, use a center distance between pulleys approximately four times the diameter of the larger pulley.

For a leather belt, the power transmitting capacity or width may be determined approximately from this formula:

$$HP = (W \times S \times T) \div 33,000$$

where HP is horsepower, W is width of belt in inches, S is speed of belt in ft. per min., and T is effective tension in pounds per inch of width.

Determine diameters of pulley by the following formulas:

For diameter of driven pulley

$$d = (D \times W) \div n$$

For diameter of driving pulley

$$D = (d \times n) \div N$$

where d and D is the diameter in inches of the driven and driving pulleys respectively, and n and N is the speed in r.p.m. of the respective pulleys.

Thrustor Electric Brake, Reduces Cost

Maintenance of an electric brake on a coal tower cost a gas company \$1,000 a year. The grab-bucket hoist in the coal tower made two to three round trips per minute and required four to six applications of the brake for every minute of operation, one at each end of the travel. With the type of electric brake in use, the brake wheel had

to be removed and machined every few weeks. The cost of repairing the wheel and the cost of stopping production to make the necessary repairs was high.

The problem was solved by the use of a thrustor-type electric brake. This brake was installed three years ago in the coal tower, at a cost of \$500.

Results of the installation were (1) a reduction in maintenance from \$1,000 to \$50 a year, (2) smoother operation, and (3) more tonnage handled per hour. Maintenance saving alone paid for the new installation in less than seven months, and since that time the brake has saved the gas company \$950 a year.

Time Relays Save Power On Elevator Operation

In the operation of buildings today owners and management are finding means and ways of taking advantage of modern equipment and devices that assure savings.

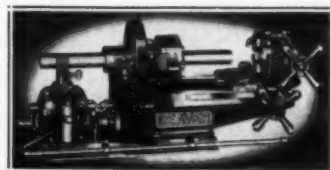
One of the latest methods is in connection with elevator motor-generator sets which are popular because of the control of speed and the leveling characteristics afforded. To shut down the motor-generator set when the car is idle for any predetermined time, a Sauter MQ time relay is connected into the motor circuit. The relay thus provides for a saving in power consumption.

The usual practice in a large building is to set aside certain elevators for night, week-end, and holiday service. These are the elevators which it has been found best to equip with Sauter MQ relays. The operator of the car should not be called upon to use his judgment in shutting down the motor-generator set when the car is idle. Real savings, amounting to four times the cost of installation, have been realized in one year.

An interesting test was recently made in one of the large buildings in downtown New York, covering a period of six months.

In the first month changes were made in the time-delay setting of the relay, to get a proper balance between length of periods of idleness and not too frequent shutting down of the motor. With frequent shutdowns, the current savings in reduced running time of the motor-generator set would be over-balanced by the increased current necessary to start the motor-generator set. The first setting was for five minutes, but this was gradually cut down to three minutes, which seems to strike the proper balance. The savings in the first month were, therefore, less than normal due to experimenting with the time setting.

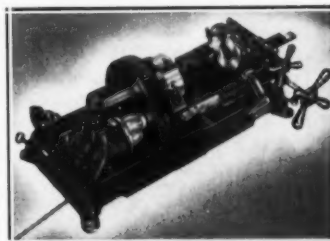
The A-B-C of . . . Pipe Machines!



Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range 1/4 to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, 1/4 to 2-inch. Wt. 415 lbs.

From \$309.50 up
Write for Bulletin A



Model-B

Big Brother to Model-C Power Unit. A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range 1/4 to 2-inch-up to 8-inch with drive shaft and geared tools. Bolts up to 1 1/2-inch. Weight 240 lbs.

From \$217.50
Write for Bulletin B



Models C-1 and C-2

A sturdy little Power Unit Converts hand pipe tools into power tools from 1/4 to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 1/2-inch. Two men can work at the same time without interference. Weight 150 lbs.

From \$125.00 up
Write for Bulletin C

Write for new Tool and Machine
Catalogue—Just off the press

BEAVER PIPE TOOLS

440 Deen Ave. Warren, O.



RIGID—the name on millions of wrenches that stay on the job. A housing that's a sort of miracle of design and alloy-metal because it won't warp or break. No "out for repairs," no repair expense, fewer "spares" needed. That remarkable housing assures you also an adjusting nut that always spins freely to size, never binds. Safe chrome-molybdenum jaws, replaceable, handy pipe-scale on hookjaw. The wrench that costs practically nothing for upkeep, outstandingly popular with electricians and other men who know fine tools. Ask your supply House . . . today!

THE RIDGE TOOL COMPANY
ELYRIA, OHIO

RIGID PIPE TOOLS



Test records have provided data from which the following savings were determined:

Installation: The test relay was used on an Otis Elevator Co.'s installation; speed 800 ft. per min., 27-floor rise, No. 3A a.c. to d.c. motor-generator set, electric doors. The relay was finally adjusted to a 3-in. setting.

Operation: The relay begins to function whenever elevator car comes to a stop. If car starts before the 3-min. interval, the coil is re-energized, preventing relay contacts from opening. Opening of relay contacts shuts down the motor-generator set.

Result: Savings were estimated on the readings of one elevator which was given its share of the light-load duty during the six-months period. In the final installation two elevators of a four-car bank and three of an eight-car bank will be set aside for light-load duty. Figures on all these elevators were taken into account for the sixteen- and six-months periods in arriving at the result.

Estimated average power consumption of 12 cars for sixteen months prior to installation of the relay was 4,023 kw.-hr. per car-mile, and for six months after installation of the relay, 3,728 kw.-hr. per car-mile. The difference is a saving of 0.295 kw.-hr. per car-mile, or, using an average power cost of \$0.02 per kw.-hr., the saving would be \$0.0059 per car-mile.

Considering the total mileage for 12 elevators per year as 55,000 miles, the estimated savings with five relays would be \$324.50. After allowance for cost of relay and installation per car at \$17.20 or \$86.00 for five cars, net saving the first year is \$238.50.

The engineer reported that during the six-months period the relay gave no operating trouble of any kind, and appears to be in as good condition after the test period as before. His recommendation for four more relays was accepted by his management. The R. W. Cramer Company, Inc., Centerbrook, Conn., supplied the time-delay relays.

Plan for Next Summer

On wintery days we think more about how to get heat than we do about keeping cool. But in a few months we will be thinking otherwise—summer heat and humidity will be with us again. Now is the time to plan for ventilation, air circulation, air conditioning to maintain production, preserve merchandise, and provide comfort for employees during hot weather.



Don't Spend Hours Chiseling Holes in Concrete!

DRILL HOLES 50-75% FASTER!

Amazing new drill-point contains special metal harder than hardest steel. Goes through concrete, tile, slate, porcelain, etc., 50 to 75% faster. Drills cleaner, more accurate holes. Speeds up installation of expansion anchors. Saves your skilled time for more profitable work. Eliminates noisy hammering, monotonous chiseling. Doesn't splinter fragile work. No special equipment needed—use in any rotary drill. Get your share of those extra profits now possible. Send coupon for leaflet.

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DETROIT, MICHIGAN

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11135 E. 8 Mile Ave., Detroit
Send free leaflet on Carboloy Masonry Drill-Points, for drilling 75% faster.

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CARBOLOY
MASONRY DRILL-POINTS

For Better Service -
INSTALL TRICO
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WRITE FOR FOLDER CPF-300

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal



TIME.. THE TESTER—

will show you
the Economy
of these "Tools of the Professionals"



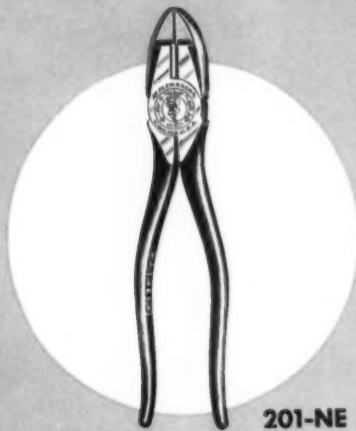
Left: Klein No. 202 Oblique (Diagonal) Cutting Plier.
Center: Klein No. 201-NE Streamlined Side Cutting Plier.
Right: Klein No. 203 Long Nose, Side Cutting Plier.

When pliers stand up under severe service and abuse day in and day out, year after year, without affecting the alignment of the jaws and knives—that means real overall economy. Klein pliers, of drop-forged steel, with all parts tempered and hardened—built by long-experienced craftsmen—withstand abuse and hold their shape and alignment. Their spring-grip handles provide full leverage and comfort for continual use in the workman's hand.

The long life, sturdiness, and dependability of Klein pliers and tools make replacements less frequent, conserve working time. Klein tools are saving money for their owners. Buy Kleins and save. Ask your distributor or write for Pocket Tool Guide.

KLEIN TOOLS

There's a Story of Safety and Efficiency in Each of these Lineman Tools You Buy



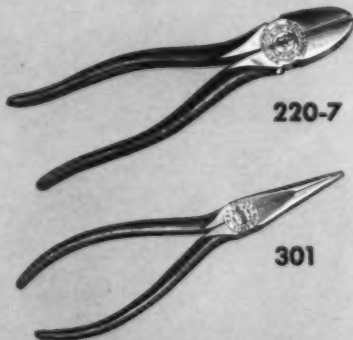
PLIERS FOR WORK

Klein's pliers are backed by 83 years' experience in producing quality tools from carefully selected materials fabricated and processed by genuine craftsmen. Their keen, hand-honed, perfectly matched cutting knives and handles with comfortable spring grip give full satisfaction to the particular workman.

Each plier is hammer-forged from high-grade tool steel made specially to Klein's analysis and is individually fitted, tempered, adjusted, and tested.

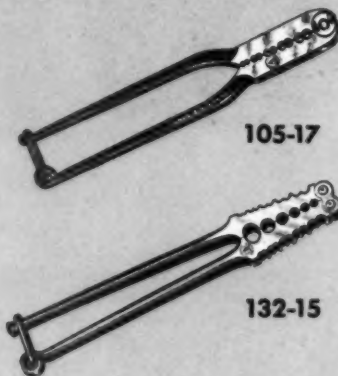
Klein's pliers are the established standard in the electrical industry and are equally accepted on steel construction and reinforced concrete work.

Many types of Klein's pliers are available, including side-cutting, oblique-cutting, end-cutting, diagonal-cutting, long nose with and without cutters, chain nose, long flat nose, long duck bill, heat coil, cord tip closing, and slip joint. Some of these types can be furnished with spring-opening handles.



Ask Your Distributor or Write for Pocket Tool Guide

Foreign Distributor—International Standard Electric Corporation, New York, N. Y.



"ANY OLD THING" WON'T DO FOR A SPLICING CLAMP

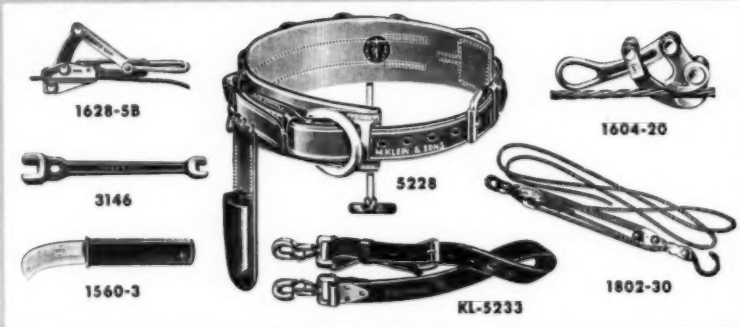
Klein's Splicing Clamps are built to take it. Forged from tough, shock-resisting steel of special composition, with the jaws tempered and hardened to resist wear, and handles proportioned to resist bending strain and retain their shape. Perfect fit of the dies for holding wires and sleeves.



CLIMBERS . . . MADE BY KLEIN

Utmost dependability is assured in Klein's Climbers. Forged from special steels and individually tempered and tested for comfort, the shanks are flexible and yield readily to the pressure of the leg. The stirrups are correctly shaped to the foot. Cuffs are set to proper angle for easy and safe climbing and are securely riveted to the leg iron.

OTHER EQUIPMENT THAT LINEMEN USE FOR SAFETY'S SAKE



No. 1628-5B—Klein's "Chicago" Grip. Will not slip or damage the conductor. An "all-purpose" grip for diameters up to $\frac{1}{2}$ ".

No. 3146—Klein's Linemen's Wrench.

No. 1560-3—Klein's Skinning Knife with insulated handle.

No. 5228—Klein's Leather Tool Belt. First quality latigo and russet harness leather with drop forged hardware.

No. KL-5233—Klein's "Klein-Kord" Safety Straps. "Klein-Lok" Snaps and Stainless Clips. The maximum safety factor.

No. 1604-20—Klein's "Haven's" Steel Grips.

No. 1802-30—Klein's Self-Locking Block Tackle.



Mathias **KLEIN** & Sons
Established 1857

3200 Belmont Ave., Chicago, Ill.

MI

WHEN CONDUCTORS MEET



The Word is..

BURNDY

YOU ARE WELCOME TO A COPY OF CATALOG 41 ON
BURNDY ELECTRICAL CONNECTORS. WRITE FOR ONE TODAY.



BURNDY ENGINEERING CO. INC.
459 EAST 133D STREET, N. Y. C.
SEE YOUR WHOLESALE ON BURNDY CONNECTORS

Estimating

[FROM PAGE 61]

150 — Insert markers
25 pounds — Cement
500 feet — 1/4-in. Galvanized conduit
20 — 1/4-in. Galvanized conduit elbows

The following is the breakdown of the labor required to make the installation.

CARTAGE—included unloading the material from the truck and carrying it to the job site.
Total time 8 m. h.

SPOTTING BOXES—included spotting all outlets in junction box locations on the wood forms while iron workers were laying steel.
Total time for 24 boxes.... 6 m. h.
Average time per box..... .25 m. h.

INSTALLING JUNCTION BOXES—included the installation of 24 junction boxes.
Total time 12 m. h.
Average time per box..... .5 m. h.

INSTALLING DUCT—included leveling with a transit and installing 1900 feet of duct.
Total time 38 m. h.
Average time per 100 feet... 2 m. h.

DUCT SUPPORTS—included installation of 160 duct supports.
Total time 27 m. h.
Average time per support... 10 minutes

DUCT COUPLINGS—included mounting of 180 duct couplings
Total time 15 m. h.
Average time per coupling. 5 minutes

DEAD ENDS—included installation of 21 dead ends.
Total time 1.5 m. h.
Average time per unit..... 5 minutes

BLANK WASHERS—included installation of 80 blank washers in junction boxes.
Total time 2.5 m. h.
Average time per unit..... 2 minutes

INSERT MARKERS—included mounting of 150 insert markers in duct outlets.
Total time 2.5 m. h.
Average time per unit..... 2 minutes

SMOOTH-ON CEMENT—included carefully sealing all joints with this cement
Total time 8 m. h.

DUCT CONDUIT FEEDERS—included installation of 500 feet of 1/4 inch galvanized conduit and 20—1/4 inch galvanized elbows.
Total time for conduit... 12.5 m. h.
Average time per 100 feet. 2.5 m. h.
Total time for elbows..... 5 m. h.
Average time per elbow... .25 m. h.

OBSERVATION DURING CONCRETE POURS—included watching duct so it wouldn't be knocked out of alignment during the pouring operation.
Total time 8 m. h.

This particular type of duct was a new material to the men on the job and the installation time rapidly decreased as the men became accustomed to handling it. Supervisory labor is not included in the above figures.

Data from E. J. White Company, Newark, N. J.

EVERY OUTLET DESERVES

A BRYANT DEVICE



CLOCK HANGERS

For modernization or new construction, adequate wiring specifications should include Bryant Clock Hangers. Beautifully finished in brown or ivory bakelite, or separable brass plate types. Standardize on Bryant Wiring Devices and be sure of uniformly high quality and superior performance. Before you buy or specify, consult your complete Bryant Catalog. You'll find more than 2,800 different devices which exactly meet every modern need.

*The Bryant Electric Company
Bridgeport, Connecticut*



SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

THERE IS A BRYANT DEVICE FOR EVERY WIRING NEED

Questions ON THE Code

Answered by
F. N. M. SQUIRES

Chief Inspector New York Board of Fire Underwriters

Gasoline Service Stations as Hazardous Locations

Q. "Can service station canopies over driveways, where gasoline is dispensed to automobile tanks, be classed as Class 1, Group D, hazardous location?"—L.S.P.

A. Generally the canopies referred to above are merely roofs over the driveways and extend from the service station offices to the gasoline pump islands and are entirely open at the ends so that cars may drive through and are also open at the island side where the pumps are located.

The area under such canopies, except the space within the dispensing pumps themselves, should not be considered as hazardous locations because of the natural ventilation.

Any switches or receptacles on or near the dispensing pumps and lower than four feet above the ground should be of the explosion-proof type.

The above refers to the service stations of the average road side type but does not include the bulk service stations of the oil companies which offer considerably greater hazards.

Grounding Conductor

Q. "Will you please advise me on the following and state the paragraph or page in the National Electrical Code upon which you base your opinion.

(1) "What type (bare or rubber covered) of conductor must be used in grounding the service equipment of a 110-220 single phase A.C. system in rural areas where no underground water system is available and driven grounds must be used?"

(2) "Under the same circumstances may the neutral conductor of a three wire 110-220 single phase system be a bare conductor or must it be rubber cov-

ered? Referring to the service entrance."—A.M.K.

A. (1) Paragraph b of section 2591 provides that the insulation of the grounding conductor shall be at least as good as that of the conductors of the interior wiring system except that no insulation is required on a common grounding conductor or where a common grounding conductor is permissible. This permissibility is governed by Section 2595.

(2) Under paragraph 2304 where the maximum voltage to ground is not more than 150 volts and where the conditions of paragraph 2595a are met, a grounded neutral conductor may be used in a rigid metal raceway or as part of an approved type of service cable.

The conditions imposed by 2595a are that the neutral shall be grounded by means of a grounding conductor of sufficient size to satisfy paragraph 2596f and, most particularly, that there shall be at least two grounds on the secondary distribution system for interior wiring.



BACK TO SCHOOL movement strikes Chicago as contractors attend classes on fluorescent lighting at the Chicago Lighting Institute. Here is Elton Gould and Bill Templeman of the Cook County Electrical Contractors Association wearing the little colored badges which distinguish the classes.

Underfloor Raceway

Q. 1. "Rule 3543 states that R.C. double braid or twin wire must be used on open bottom underfloor raceway. "Could S.B., V.C., or R.C. single braid be used for the types of underfloor raceway?"—F.R.B.

Q. 2. "Rule 3542 seems to allow open type raceway to be used between the finished floor and rough floor without a pad, while rule 3549 states that a pad must be used. "Will you please explain this?"—F.R.B.

A. 1. Where the open bottom type of underfloor raceway is placed on a cement pad and rubber covered wires used, the wire must be double braided or twin wire. Varnished cambric covered wire could be used if the location is dry. Slow-burning wire would seldom be permissible as the temperature would very rarely run over 120°F.

Where the open bottom type of underfloor raceway is not placed on a cement pad but is on the rough floor, plain wire of any kind is not permitted and only armored cable or non-metallic sheathed cable may be used.

With the closed bottom type of underfloor raceway there are no such restrictions as above and single braid rubber covered wire may be used.

A. 2. The final part of the first sentence of section 3549 is an exception which provides that where the cement pad is not used under the open bottom type of underfloor raceway, fittings must be used which will protect the wire within the raceway.

Transformer Hookup

Q. "As one of your Canadian subscribers I am taking the liberty of writing for information.

"We have two single phase transformers, primary connected 3 phase, 13000 volts, 3 legs, secondary 110-220 for lighting, 100 K.V.A. rating, connected as per sketch No. 1 to a five bus bar secondary distribution.

"I would like to know if it is possible to ground No. 4 and 5 bus bars on sketch as we are now with no grounds and cannot use standard lighting equipment as Code requires, and if possible to connect 2 single phase transformers in parallel on secondary and on each leg of primary three phase. I heard power companies do it on distribution transformers as per No. 2 sketch."—W.G.

A. We are indeed pleased to hear from one of our Canadian readers and trust that our answer to this

Electrical Contracting, April 1940

FOR REWIRING EXISTING RACEWAYS

G-E PRESENTS FLAMENOL Small Diameter Building Wire

Now! Existing buildings need no longer be starved for electrical current. Wattages can be increased inexpensively by rewiring raceways with Flamenol Building Wire. This small diameter wire is available in sizes 14 to 4/0 inclusive. It is insulated with a plasticized polyvinyl chloride compound which is tough, long aging, flame retarding . . . has high dielectric and mechanical strength . . . resists oil, acids, alkalis and moisture. The compound serves both as an insulation and as a finish.

Small Diameter

The reduction in the diameter from .190" to .130" for #14 AWG wire, for instance, makes it possible to install nine #14 wires (pending 1940 Code) in a 1/2-inch conduit instead of the present four #14 wires (see table below for comparative overall diameters). As an example, it will be possible to increase wattage from 2760 watts to 10368 watts by using 8 Flamenol building wires and changing the system from 2-wire, single-phase to 4-wire, three-phase.

Flamenol building wire may be obtained in a variety of bright, permanent colors. Color goes all through the insulation and therefore may easily be determined by cleaning or scraping if the wire becomes soiled. A hard glossy wax surface makes wire pulling easy.

Features of Flamenol Building Wire

1. **Small Diameter**—Saves space, makes wiring jobs easier.
2. **Superaging**—Ages better than rubber-insulated wire.
3. **Easy Pulling**—Has hard, smooth, glossy surface.
4. **Heat Resistant**—Rated at 60 deg. C.
5. **Free Stripping**—Makes splicing and soldering easier.
6. **High Dielectric Strength**—720 volts per mil, test result.
7. **Flame Resistant**—Will not support combustion.
8. **Tough Insulation**—Tensile strength of 2000 lb. per sq. in. test result).
9. **Many Colors**—Same colors normally supplied on Type R wires.
10. **Oil Proof**—Unaffected by oils, water, acids and alkalis.
11. **Attractive**—Dirt, etc. does not readily adhere to wire's surface.
12. **Self-protecting**—Protection needed only against severe mechanical abuse.

For Further Information

See the nearest G-E Merchandise Distributor or write to General Electric Company, Section W-0124 Appliance and Merchandise Department, Bridgeport, Connecticut.

Hooray!
at last!
We can have
new branch
circuits
and feeders

3.7
2760/10368.0
8280
20880
19320
1560
Elec. Dept.
Pl. investigate:
3.7 times more
wattage.
Relighting
possible now.)

NEW LIFE FOR
OLD BUILDINGS

COMPARISON OF DIAMETERS

Size AWG	Approximate Overall Diameter (In.)		Size AWG	Approximate Overall Diameter (In.)	
	Rubber Covered Types R, RP, RH	Flamenol Type SN		Rubber Covered Types R, RP, RH	Flamenol Type SN
14 Sol.	.193	.130	1 Strd.	.568	.496
12 Sol.	.210	.147	1/0 Strd.	.609	.537
10 Sol.	.231	.168	2/0 Strd.	.655	.583
8 Strd.	.322	.246	3/0 Strd.	.706	.634
6 Strd.	.398	.314	4/0 Strd.	.764	.692
4 Strd.	.447	.363	up to		
2 Strd.	.507	.423	2,000,000 CM		

GENERAL  ELECTRIC

How YOU, Too, Can Make Money Out of This New Fluorescent Lighting

\$\$\$ Miller-Ivanhoe gives contractors fixtures made to exacting standards plus superlative engineering and service—and an easy-to-follow, money-making formula.

Thousands and thousands of dollars are being spent to promote Fluorescent Lighting. *It is salable!* Industrial plants and commercial establishments all want it. Many have bought it already.

Are you getting your share of this great business? And . . . are you making any money out of it? We have been working with many contractors who are.

These contractors use this money-making formula—

1. They use Miller-Ivanhoe equipment, which is soundly engineered and constructed, and well and favorably known (and advertised) to their customers.
2. They take advantage of the cooperation from their nearby Miller distributor from whom they get sound, sales-making engineering service.
3. They tie-in with Miller sales promotional recommendations which produce more business for them with a given amount of sales effort—which means *they make more money!*

HERE IS AN ACTUAL EXAMPLE . . .

Contractors in many states, working hand in hand with Miller and their Miller Distributors, are making new and profitable sales of Fluorescent Lighting to textile mills. These contractors find their job easier and their profits longer because of Miller's 1940 Textile Sales Program.

Write us today, or get in touch with your nearest Miller-Ivanhoe distributor for details of this sales-making Miller Textile Program, and for your copy of the new Miller Fluorescent Catalog.

You make more money and have fewer headaches when you sell Miller-Ivanhoe Lighting Equipment



THE MILLER COMPANY, Meriden, Conn.
Pioneers in Good Lighting Since 1844

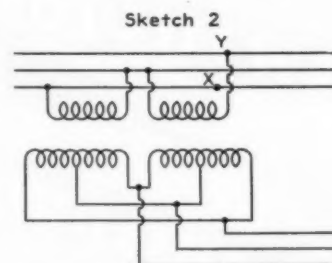
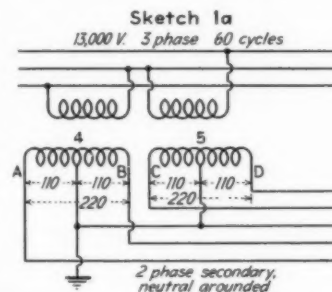
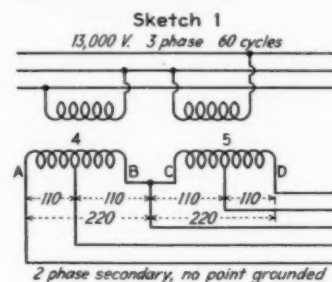


[FROM PAGE 64]

question may be of some aid to him.

In the sketch No. 1, while the primary supply line is a three phase one, only two of the phases are employed and the secondary distribution system is a two phase system.

As long as points B and C are connected together as shown in the sketch, (No. 1) it would be impossible to ground both points 4 and 5 as there is



a difference of potential of about 155 volts between points 4 and 5. To connect them together (by grounding both) with points B and C connected would produce a short circuit.

But if B and C were *not* connected then it would be possible to connect points 4 and 5 and to ground them.

The result of doing this would be the above sketch 1A, of a two phase, 5 wire system in which points 4 and 5 become a neutral (N) for both phases and should have a carrying capacity of 141 per cent of the carrying capacity of the phase wires.

This, then, would permit compliance

Electrical Contracting, April 1940

Thumbs up!

New Westinghouse
Push Buttons...save
space...stop fumbling
...improve appearance!



It's a unanimous "thumbs up" sign of approval that machine operators give the new Westinghouse Type SD push button.

Its large buttons are easier to operate . . . its shrouded design and optional safety latch protect machine and operator from accidental operation . . . and its compact, modern design is tops in appearance!

For any control circuit application . . . for any type of mounting . . . you'll be interested in the added convenience and appearance that Type SD push buttons offer. Write for the new bulletin describing them—bulletin 15-020.

ROTARY SELECTOR SWITCHES



Rotary selector switches provide an optional type of control station with the same modern lines and appearance as the new Westinghouse push buttons.

ENCLOSURES FOR EXPOSED LOCATIONS

Dust and watertight enclosures, where desired, make Type SD push button units available for outdoor or exposed locations.



Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Dept. 7-N.

J-20883

Westinghouse *Type SD* Push Buttons



For economy and permanence use R & S electrical specialties



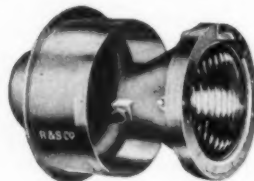
Explosion Proof and Dust-Tight for Hazardous Locations

- Lighting Fixtures 100 to 500 Watts
- Switches—10 to 200 Ampere
- Circuit Breakers 10 to 600 Ampere
- Across The Line Starters to 100 HP.
- Receptacles and Plugs to 60 AMP.
- Sealing Fittings, Junction Boxes, Etc.



Water-Tight and Weather- Tight for Outdoor and Moist Locations

- Lighting Fixtures—75 to 300 Watts
- Switches—10 to 200 Ampere
- Circuit Breakers—10 to 600 Ampere
- Receptacles and Plugs to 400 Ampere
- Junction Boxes, Cable Supports
- Everlok Receptacles and Plugs
- Floor Boxes and Receptacles
- Submersible Flood Lights for Swimming Pools and Fountains



Years of experience in the design and manufacture of special electrical equipment for nearly every industry including government and municipal departments qualifies Russell & Stoll to furnish the correct material for the most exacting requirements.

An efficient Engineering Staff is at your service in preparing layouts and details for any electrical specialty, without any obligation to you.

Write for New 1940 General Catalog

RUSSELL & STOLL COMPANY, INC.
150 PARK PLACE NEW YORK, N. Y.

*Questions
in the Code*

[FROM PAGE 66]

with the Code in respect to the use of standard lighting equipment and grounding. Lighting circuits would be taken by using any phase wire with the neutral which would give 110 volts. No fuse would be used in the neutral.

The following voltages are obtainable; any phase wire to neutral 110 volts.

Phase wire A to phase wire B = 220 v

Phase wire C to phase wire D = 220 v

Phase wire A to phase wire C = 155 v

Phase wire B to phase wire D = 155 v

Two phase power may be taken from phase wires A B D C.

The connections as shown for the secondary would be impossible unless both transformers had their primaries connected to the same phase.

In other words, the connection at Y would have to be shifted to point X.

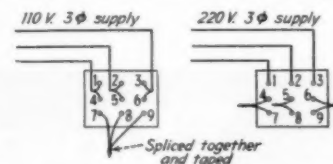
Then but one phase of the primary would be used and the secondary connection would give 3 wire, single phase.

Connections for Delco Refrigerator Motor

Q. "How do you connect a 1½ HP Delco 3 phase 110-220 volt motor to a 3 phase line? This motor had nine wires brought out, each with a metal tag from 1 to 9, in the form of a square, 3 wires to a side. Please illustrate it by a diagram if possible.

"I never heard of a double voltage on a 3 phase machine before, cannot find any mention of it in any reference books I have and I think it would be interesting to many others. This motor was supplied for commercial refrigeration duty. It was sent to replace a single phase machine so I did not have to connect it, therefore didn't get stuck, but others might and I might sometime."—R.C.E.

A. This question is not a National Electrical Code matter and should not have been sent to this department.



ment but should have been sent to the Motor Manufacturer from whom undisputable advice could be secured. However, a representative of this manufacturer has provided two diagrams on this subject which are given here for what they may be worth.



"Through Every Step"

Limiting its activity solely to the making of electrical wires, cables and accessories, General Cable carries the processes of manufacture through every step in its own plants. General Cable rolls its own copper rods, draws its own wire, creates its own insulating compounds, and does all those many other things involved



in the manufacture of electrical conductors. Through every step, quality is held to standards prescribed by the General Cable Research Department and maintained within the same exact limits in all company plants. Uniformity of quality has been an outstanding advantage of General Cable Wires and Cables.

GENERAL CABLE

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

Stocked by Electrical Wholesalers Everywhere

General Cable Corporation Sales Offices: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • KANSAS CITY (MO.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROME (N.Y.) • ST. LOUIS • SAN FRANCISCO • SEATTLE • WASHINGTON (D.C.)

In the News

NECA DELEGATES TO CHAMBER OF COMMERCE

The National Electrical Contractors Association has appointed seven delegates to represent it at the 28th annual meeting of the Chamber of Commerce of the United States to be held at the National Chamber Building, Washington, D. C., on April 30 to May 2 inclusive.

Delegates named are Robert W. McChesney, National Councillor, Washington; A. Lincoln Bush, New York City; W. Edward Frazer, Philadelphia; A. Herrman Wilson, Washington; H. W. Kellams, Washington; T. W. Wilmer, Richmond; E. C. Carlson, Youngstown. Paul M. Geary, Youngstown is acting as alternate for Mr. Carlson.

W. Gibson Carey, Jr., president of the National Chamber has extended an invitation to all NECA members to attend this meeting. Important subjects up for discussion at this meeting include national economy and reduction of federal expenditures.

TENNESSEE CONTRACTORS CONVENE

The Tennessee Electrical Contractors Association held its annual convention March 25-26 at the Claridge Hotel, Memphis. State President J. C. Campbell of Nashville was chairman at the convention and presided over a program of interesting addresses by Joseph A. Fowler, Executive Director of Memphis Housing Authority; W. R. Herstein, Memphis; Major Thomas H. Allen, Chief Engineer, Memphis Light, Gas & Water Commission; D. B. Clayton, NECA Executive Committeeman, Birmingham; L. W. Davis, General Manager, NECA; Paul M. Geary, Representative, Labor Relations Committee, NECA; and H. J. Reinhardt, Vice President, Frank Adam Electric Co., St. Louis.

The two afternoons were devoted to inspection trips through the South Gate Sub-station and the Firestone Rubber Company plant.

CALIFORNIA CONTRACTORS MEET AT STOCKTON

The Electrical Contractors' Assn. of Northern California will hold its annual meeting and election of officers on April 20 at Stockton, Calif. Ken Ryals, Stone-Ryals Electric and Manufacturing Co., San Francisco, president of the association, has announced that the program will consist of discussion of recent California state license cases, any new developments in the Federal investigation of the building industry, sales policies in relation to construction materials and the 1940 edition of the National Electrical Code. R. Goold, Eddy Electric Company, Stockton, and vice president of the Association, is in charge of local arrangements.

A-W ACTIVITIES

The National Adequate Wiring Bureau activities are in full swing for 1940. All over the country new groups are being formed, licenses issued and programs planned. Here are some of the activities in various cities.

Los Angeles, Calif.—Large domestic builders are cooperating with the electrical industry in promoting and advertising adequate wiring in residential homes.

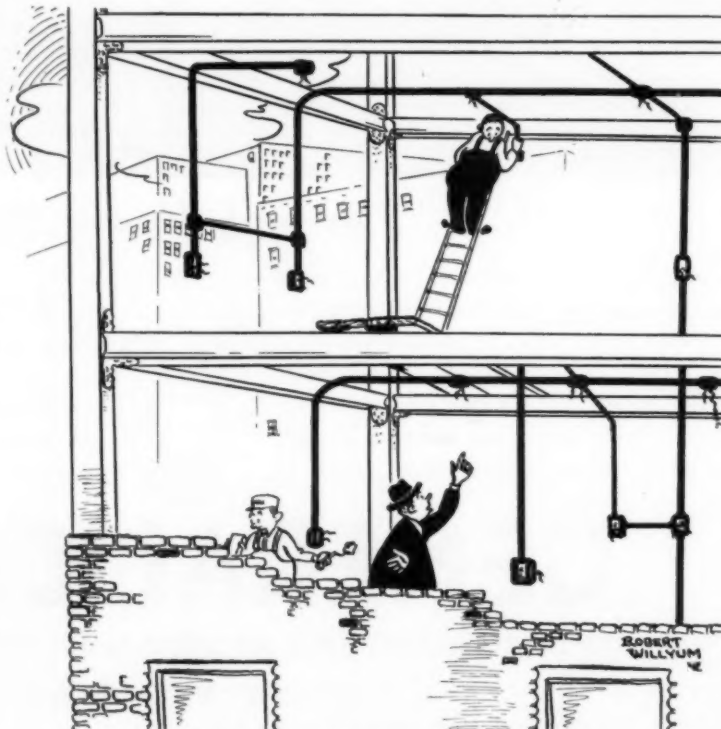
Sacramento, Calif.—Monthly bulletin of local A/W Bureau announced that the Sacramento Electrician's Local 340 of the IBEW had started a six months' course on adequate wiring and lighting, conducted by Clark Baker, lighting counselor of the Pacific Coast Electrical Bureau.

Yakima, Wash.—Results of January Convenience Outlet Campaign of the Pacific Power & Light Co., show the installation of 2120 convenience outlets as compared with 1200 outlets in the same months last year and 600 in 1938.

Denver, Col.—Rocky Mountain Electrical League was host to Denver's building contractors and architects at a dinner meeting, the first of a series designed to acquaint all industries, trades and professions with the adequate wiring movement.

Minneapolis, Minn.—North Central Associated Electrical Industries gets license to certify Adequate Wiring installations in the entire state of Minnesota.

Peoria, Ill.—A local A/W Bureau was organized following two meetings at which

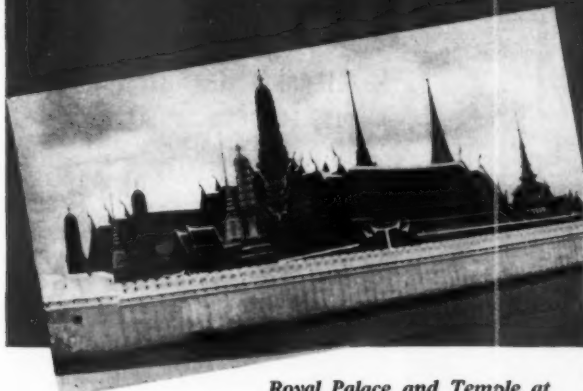


"You electricians will have to slow up a bit and let the rest of the boys catch up!"

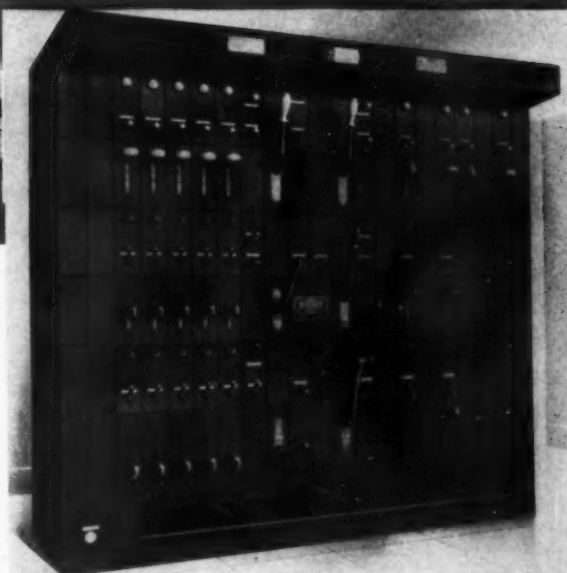
THE KING OF SIAM

equipped the private motion-picture theater in the royal palace with an

FA STAGE LIGHTING CONTROL SWITCHBOARD



Royal Palace and Temple at Bangkok, Siam and the FA Pilot Switchboard installed therein.



In foreign countries, as well as in almost every State in the Union, FA Equipment is chosen by many architects, engineers and contractors because FA Products are *made better than necessary*—of pleasing design as well as maximum efficiency.

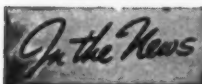
Having specialized in Stage Lighting and Dimmer Control since 1904, it is but natural that FA Stage Lighting Control Equipment fits the particular (and often complicated) requirements of such installations, at an ultimate saving to the user because of trouble-free, lasting service.

Whether your problem concerns a small school—a recreation center—or a large auditorium—there is a suitable type of FA Lighting Control Switchboard for its needs.

**Avail yourself of the experience
of FA Sales-Engineers in this
highly-specialized field**

Located in principal cities, they will be glad to give you the benefit of their many years of training. Write for the name and address of the one nearest you . . . And ask for Catalog No. 56. . . Frank Adam Electric Company, St. Louis, Mo.





[FROM PAGE 70]

contractors, wholesalers, architects, builders and utility and industry representatives were acquainted with the adequate wiring program.

Baton Rouge, La.—More than 2000 persons registered at the Gulf State Utilities Company's adequate wiring booth in the recent National Home Show.

Grand Rapids, Mich.—The Grand Rapids Adequate Wiring Bureau is the thirty-first group to receive a license to operate the

certification plan. Their territory covers the city of Grand Rapids and Kent County.

South Bend, Ind.—Indiana and Michigan Electric Company sponsored an organization meeting to formulate a local program to tie in with adequate wiring activities. A. C. Tait, National Bureau field representative discussed the program and a temporary committee was appointed to form permanent plans.

Elkhart, Ind.—Electrical contractors and jobbers of Elkhart enthusiastically received A/W story at a meeting sponsored by the South Bend A/W Bureau. Local committee was appointed to form plans for an adequate wiring program.

Dayton, Ohio—An Adequate Wiring Bureau has been established through the

cooperation of the Dayton Power & Light Company, the Ohio Inspection Bureau and leading electrical contractors and dealers.

Richmond, Va.—The Virginia Electric & Power Company has joined the ranks of those utilities using their Service Department to promote wiring modernization. A letter with a copy of the National A/W Bureau's "Check Your Wiring" folder is sent to all leads sent in by the company's trouble shooters.

MAINTENANCE MEN CHOOSE LEADERS

The following men were recently elected to serve on the Executive Committee of the Electrical Maintenance Engineers Association of Southern California. R. Glen Woods, president, National Biscuit Co.; Glenn Farr, vice president, R. K. O. Studios, Inc.; Jerry W. Ellis, Knudson Creamery Co.; Walter P. Ritter, American Can Co.; Warren W. Storkey, E. K. Wood Lumber Co.; Howard C. Park, General Motors Corp.; Jerry S. Jacobs, City of Long Beach; Harold J. Hutt, Pacific Coast Borax Co.; Samuel J. Lindsay, Wilshire Oil Co.; and C. F. Kimball, secretary-treasurer, Ford Motor Company.

BENEFIELD HEADS GEORGIA IAEI

F. H. Benefield of Atlanta, Fulton County electrical inspector, was elected chairman of the Georgia Chapter, International Association of Electrical Inspectors, at its annual convention. Other officers chosen included C. V. Reynolds, city inspector of Savannah, first vice president; Robert B. Alford, field engineer, Georgia Public Service Commission, second vice president; Carl W. Evans, Atlanta, secretary-treasurer. W. E. Foote, Sr., electrical inspector of Griffin was elected chairman of the executive committee.

AN INSTALLMENT PLAN FOR WIRING

At the request of the distributors of G.E. wiring products, General Electric Contracts Corporation has worked out a simple plan of selling wiring on the installment basis. It is expected to encourage the installation of more adequate wiring and quality equipment.

The plan operates under FHA terms. The contractor sells adequate wiring and better fixtures, without a down payment, giving the customers up to 36 months to pay. And payments may be as low as \$4.50 per month.

The contractor is not required to put up any cash. Transactions covering wiring, fixtures and labor may be financed up to a maximum of \$2,500, but in existing buildings only.



AT MINNESOTA ELECTRICAL CONVENTION—(top left) Al Kessler of North Central Associated Electrical Industries; (top right) Ed Karst of Fergus Falls chats with Carl T. Nimis, one of seven to receive 50 year Golden Jubilee Award; (bottom left) Roy Springer of Superior, Wis. and Ed Herzberg, of Wisconsin Electrical Association; (center right) Ed Micka of Hibbing and L. E. Schaeffer of Pipestone; (bottom right) Wm. A. Ritt of St. Peter and Paul Schorr of St. Paul.

IS THIS

FEATURE

ON THE TIME-SWITCH YOU NOW BUY?



★
STURDY SILVER
CONTACTS ASSURING EXCEP-
TIONALLY LONG CONTACT LIFE
BY INTERRUPTING THE CURRENT
FLOW IN LESS THAN HALF A
CYCLE.



BECAUSE the contacts are vital points in any time-switch, the contact mechanism of Sangamo Time-Switches is designed for exceptionally long life. This design includes the use of pure silver contact buttons, and a patented lever action which, by providing a positive motion through a small gap, interrupts the current flow in less than half a cycle. Buy "Sangamo"—the time-switch that has *all* the essentials of a good time-switch: accuracy, dependability, convenience, and longevity!

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS



EASIER AND FASTER FOR THE MAN ON THE JOB

Ask the man who knows . . . the operator right out on the job doing the bending . . . and he'll tell you that bending conduit with the Greenlee Hydraulic Bender is even easier than it looks. He'll tell you how simple it is by just pumping the handle to get the pressure needed to bend the pipe. Then he'll tell you that the smooth even bends made by the Greenlee make it easier to pull in wire and cable. He'll also agree that one of the best things about the Greenlee is the ease with which it can be carried to the job and set up.

And to make it easier to bend both the larger and smaller conduit, the Greenlee is made in two sizes. The No. 770, with a maximum pressure of 25-tons, to bend conduit from 1 1/4 to 3-inch size, and the No. 775, with a maximum pressure of 40-tons, for the 3 to 4 1/2-inch size. You can't afford to waste time and money bending pipe the hard way when you can do it so easy the Greenlee way!



GET YOUR FREE COPY NOW

Here's your guide to better buying of tools for electrical work. It is a handy reference to the complete Greenlee line for the electrician, including Conduit Benders, Cable Pullers, Knockout Tools, Radio Chassis Punches, Joist Borers, Electricians' Bits, Pipe Pushers and Push Drills. Mail the convenient coupon today!

GREENLEE TOOL CO.
1706 COLUMBIA AVENUE
ROCKFORD, ILLINOIS

GREENLEE TOOL CO., 1706 Columbia Ave., Rockford, Ill.

☐ I NEED A COPY OF GREENLEE CATALOG NO. 31E

☐ ALSO INFORMATION ON

Name

Address

City

State

My Jobber is

E. C. 4-40



[FROM PAGE 72]

And here is how it works:

1. The GECC checks the prospect's credit and turns the information over to the distributor.

2. After clearing credit with GECC, the distributor promptly delivers materials for the job to the contractor—without any payment being made.

3. When the job is completed the contractor secures proper papers from the customer including note and certificate of completion.

4. Without recourse, the contractor endorses the note to the distributor.

5. The distributor, without recourse, sells the note to GECC, who immediately pays to the distributor the full amount of the note less the small FHA charge.

6. Upon receipt of the funds, the distributor deducts the amount due him from the contractor for the materials purchased and sends him a check for the difference.

Thus the contractor is paid in full upon the completion of each job. He has no liability on the notes made payable to him. And his customer has up to three years to pay for the installation. The only monetary expenditure the contractor must make during construction is for labor.

This plan is expected to prove a boon to the rewiring market, now that small diameter building wire is available.

FLUORESCENT REGULATIONS

The City of New York Department of Water Supply, Gas and Electricity has issued a six page Bulletin No. 18 containing special rules governing the construction, wiring and installation of fluorescent tube type lighting fixtures in New York City. It is effective as of February 1, 1940.

COOPER HEADS MINNESOTA INSPECTORS

H. U. Cooper of Waseca succeeds R. C. Condon of Shakopee as president of the Minnesota Electrical Inspectors Association. S. M. Streed, Minneapolis, is the new vice-president, and Glen Rowell, Minneapolis, secretary-treasurer. The executive committee consists of Oscar M. Frykman, Allan Wolfe and R. J. Moudry.

STOKERS CLICK IN KANSAS CITY

A year ago, Kansas City Power & Light Company officials, electrical contractors, dealers, and coal dealers were worried about gas. The gas company was pushing a complete bill of goods, house

The year's report, from February 1939 to the first of 1940 showed 788 stoker installations made, equal to nearly half of all stokers sold before 1939. Outside of Kansas City but within the radius of the campaign another 735 stokers were installed during the year.

Milwaukee Electrical Maintenance Engineers Assn.—Convention and Exhibit, Public Service Building, Milwaukee, Wis., April 19-20.

National Industrial Service Association, Inc.—Annual Convention, Book-Cadillac Hotel, Detroit, Mich., April 22 to 24.

North Carolina Association of Electrical Contractors—Annual Convention, O'Henry Hotel, Greensboro, N. C., May 2.

National Electrical Manufacturers Association
—Spring meeting, The Homestead, Hot Springs, Va., May 12-17.

National Electrical Wholesalers Association
—Annual Convention, The Homestead, Hot
Springs, Va., May 19-23.

New York State Association of Electrical Contractors and Dealers—Annual Convention, Lake Placid Club, Lake Placid, N. Y., June 17-20.

International Association of Electrical Inspectors—Southwestern Section, Santa Barbara, Calif., August 26-30, Northwest-ern Section, Great Falls, Mont., Sept. 3-6, Southern Section, Houston, Texas, Sept. 16-20, Western Section, Kansas City, Mo., Sept. 23-27; Eastern Section, New York, N. Y., Oct. 7-11.

**National Electrical Contractors Assn. —
Annual Convention, George Washington
Hotel, Jacksonville, Fla., Oct. 21-23.**

National Electrical Manufacturers Assn.,—
Annual Conference, Waldorf-Astoria Hotel,
New York, N. Y., Oct. 27 to Nov. 1.

Bob Downing, past president of the Essex Electrical League, was recently elected president of the New Jersey Council of Electrical Leagues. Other Council officers are: first vice president, Henry G. Clum; second vice president, Richard Ruitter; treasurer, Edward Gardner and secretary, J. L. Fuller.

L. C. Kent, director of the General Electric Institute at Nela Park announced the following schedule of courses and conferences to be offered at the 1940 spring and fall terms.

April 1 to 5...Elementary Commercial & Industrial Lighting Course
April 22 to 26...Advanced Commercial & Industrial Lighting Course
May 6 to 7...Street Lighting Conference

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE



Millions of feet of CRESCENT Service Entrance Cable now in satisfactory service is factual evidence of its high quality. It is tamperproof, resistant to all weather conditions, flame retarding, highly flexible for bending around corners and can be painted to match the color of the building. It is light in weight, eliminates the need for rigid conduit and is made in a complete line to cover all requirements of any installation.

CRESCENT Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

MONOTUBE STEEL POLES *Make Good "Under the Lights"*

★ You can recommend and install Monotubes with complete confidence because the many thousands of these steel poles used in the floodlighting of sports fields, service stations, industrial yards and parking areas give proof to their dependability and correctness of design.

Monotubes are the product of specialists in steel pole construction. Made of high grade open hearth steel their natural strength is further increased by the Union Metal cold rolling process. Long life with minimum maintenance makes for low final cost. And the beauty of these plain round or fluted tapered shafts contributes to the general effectiveness of the installation.

It will pay you to compare the advantages of these modern steel poles versus make-shift types of mountings. Write today for FREE catalog describing Union Metal Monotubes for floodlighting service.



**FOUR
MONOTUBE
STEEL
POLES**

*were used in
the flood-
lighting of
this softball
diamond at
Park Ridge,
Illinois.*



Send me copy of your Catalog No. 70 describing Union Metal Monotube Floodlighting Poles.

Name _____
Company _____ Title _____
Address _____
City _____ State _____

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO



[FROM PAGE 75]

- May 8 to 9... Annual Conference of Utility Lighting Directors
- May 20 to 24... Advanced Home Lighting Course & Annual Conference of Home Lighting Supervisors
- Sept. 4 to 6... Elementary Home Lighting Course
- Sept. 23 to 27... Elementary Commercial & Industrial Lighting Course
- Oct. 7 to 11... Advanced Commercial & Industrial Lighting Course
- Oct. 21 to 22... Annual Conference for Lighting Customers.

RE-INSPECTION CAMPAIGN

The Minneapolis Electrical Contractors Association is planning to launch an extensive re-inspection campaign early this spring.

The Association is taking advantage of a revived public concern over "home-made" wiring and other fire hazards. This was prompted by a recent disastrous apartment house fire which, although not traceable to defective wiring, has made the people "safety-minded".

INDUSTRIAL MODERNIZATION IN KANSAS CITY

The Electric Association of Kansas City has taken another progressive step. At a recent meeting the new Board of Directors voted an increase in the operating budget, over that of 1939. The new plans include an extensive Industrial Modernization activity.

BOOK REVIEWS

Practical Electrical Wiring

A book of practical information on electrical wiring for residential, farm, commercial and industrial applications. Combines basic theory with practical installation problems.

Part I covers the basic principles of electricity, types of current, power factor, transformers, basic devices and circuits, grounding, wiring methods, good lighting, small motors. Part II covers actual methods of residential and farm wiring from service entrance to outlets, also isolated lighting plants and apartment house wiring. Part III deals with the planning, problems and wiring of non-residential buildings. The appendix includes a number of Code tables.

The book is written plain enough for the beginner and complete enough for the experienced wireman. Practical Electrical Wiring, Residential, Farm and Industrial. By H. P. Richter, member IAEI, ASAE. Price \$3.00. 503 pages. Cloth bound. McGraw-Hill Book Co., 330 W. 42nd St., New York City.

Measurement of A. C. Energy

This book deals with the theory, construction, operation and application of the watt-hour meter in the measurement of electrical energy.

Full chapter discussions cover the history; theory of torque production; watt-hour meter

SPECIFY *and* INSTALL LEVITON

QUALITY WIRING DEVICES



WIRING DEVICES EXCLUSIVELY . . .



Wherever wiring devices are needed, you'll find Leviton has the answer. Progressive engineering, and a plant equipped with up-to-the-minute machinery assures dependable quality and prompt delivery.

DO YOU HAVE THIS
LEVITON CATALOG
and DATA BOOK?

*Write today
for
Your Copy!*



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LOS ANGELES CALIF.
420 S. San Pedro St.

↑
SEE THIS
DISPLAY
AT YOUR
LOCAL
WHOLE-
SALER

↑
WIRE
AHEAD
WITH
LEVITON!

Here is the Fan they'll Buy in 1940



**GENERAL
ELECTRIC**
10" SPECIAL

Because . . .

it's styled to the times—and ahead of them . . . it's priced right . . . it's backed by G-E advertising and promotion* . . . the General Electric name spells quality.

THOUSANDS OF DEALERS CAN'T BE WRONG

Literally thousands of dealers have tied in with G-E Fans for 1940. Almost without exception their orders include a generous stock of the G-E 10" Special. We'll take the dealers' verdict any time.

See your G-E Distributor today for full details on the 10" Special and other G-E Fans which make up the most complete line of fans in the industry.

They'll ask for G-E Fans . . . give them what they want

FAN SALES SECTION, APPLIANCE AND MERCHANDISE DEPT., GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONN.

GENERAL  ELECTRIC

*And Here's the Backing Every G-E Fan Dealer Will Get FREE

1. A full-color "stopper" display designed to catch the eye—and hold it!
2. Smart catalogs full of selling facts!
3. Direct-mail pieces to help build your volume!
4. Convincing ready-made newspaper mats for local use!
5. Powerful National newspaper ads in over 175 key cities—run at the best time to sell fans—in local hot weather!

And a plus you can't ignore—dominant, colorful National magazine advertising which month in and month out helps maintain user acceptance and keep the G-E name constantly in the limelight.

In the News

[FROM PAGE 74]

use; constants; gear and register ratios; vector analysis; compensation of errors; polyphase metering; analytical checking of metering schemes and metering special circuits.

A fine text and reference for those interested in energy measurements. The Measurement of Alternating Current Energy. By Donald T. Canfield, Associate Professor of E.E., Purdue University, member AIEE. Price \$2.00. 210 pages. Cloth Bound. McGraw-Hill Book Co., 330 W. 42nd St., New York City.

— WITH THE —
Manufacturers

G.E. Personnel Changes

F. H. Winkley, manager of the Lighting and Cable Division of the General Electric Company, retired from active duty March 1, after 31 years of continuous service. Two divisions will replace the one of which Mr. Winkley was head, with A. F. Dickerson appointed manager of the Lighting Division and W. V. O'Brien manager of the Wire and Cable Division.

Graybar Changes

Graybar Electric Company, New York, recently announced the following appointments: A. J. Eaves, formerly Research Products Sales Manager, as Assistant General Telephone Sales Manager. He will be in charge of the Telephone Department and Research Products Department, handling all Western Electric products.

Reporting to Mr. Eaves will be J. B. Long, formerly Telephone Sales Engineer, as Telephone Sales Manager; and G. L. Donnett, formerly Research Products Sales Engineer, as Research Products Sales Manager.

L. D. Gore will continue his duties as sales manager of Western Electric Hearing Aids.

New Kwikon Agents

Kwikon Company, Chicago, Ill., has appointed the following sales agents—

George N. Seiss, 318 Auditorium Bldg., Cleveland, will cover northern Ohio. Wilfrid B. Goldschmidt, 208 Delmar Ave., Cincinnati, will cover southern Ohio.

Wood & Anderson Co., 915 Olive Street, St. Louis, will cover eastern Missouri and southern Illinois.

Ernest T. Hail of Houston, will cover Texas. The Hastings Richards Co., Albuquerque, will cover Arizona and New Mexico.

Frank H. Bran Company, 894 Folsom Street, San Francisco, will cover northern California.



PANTHER & DRAGON TAPES

①

②

③

④

⑤

Sold Exclusively Through Distributing Jobbers



HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta

Dallas Washington Cleveland



Pittsburgh Buffalo Boston Detroit Seattle

San Francisco St. Louis Los Angeles

FLOOR BOXES and WIRING SPECIALTIES

No. 285 Double Duplex Receptacle Nozzle



The most attractive, compact, easy-to-install fitting on the market. Shown in the accompanying illustration with No. 200 Cover Plate.

No. 470 Pipe or Conduit Hanger



Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Does away with drilling or use of straps. Handles 1/2", 3/4" and 1" size pipe, to steel beams 3/8" thick.

No. 330 "Latrobe" Tom Thumb Utility Outlet



To be used in wood installations and other locations free from moisture or mechanical injury.

• The Latrobe Line is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time — an important point to consider when selecting floor boxes and wiring specialties.

Write for details TODAY!
FULLMAN MFG. CO.
LATROBE • PENNA.

In the News

[FROM PAGE 78]

Metropolitan Device Corporation, Brooklyn announces the appointment of L. G. Snyder as sales manager in charge of Central Station sales.

Cutler-Hammer, Inc., Milwaukee, has appointed E. K. Anderson as manager of its branch office at 624 Santa Fe Building, Dallas, Tex. This office serves the state of Arkansas, Texas, Oklahoma and the southern part of New Mexico.

Clarostat Mfg. Co., Inc., of Brooklyn, N. Y., announces the appointment of Frank Murphy as its sales engineer in the Chicago area. His office is located at 540 North Michigan Blvd., Chicago, Ill.

Sparks-Withington Company, Jackson, Michigan, has announced that Edwin T. H. Hutchinson will direct the general sales and merchandising program of The Horn Division through the jobber and dealer trade. He has been with Sparton for the last twenty years.

G.E. Exhibit

An exhibition of electrical progress with many informative exhibits and a special showing of General Electric's House of Magic is being presented by G-E Supply Corporation houses in ten industrial centers between January 29 and June 1. New products and new ideas are shown in a review of electrical apparatus, wiring materials, ventilation, lamps and lighting. The show will be presented in Buffalo, Cleveland, Detroit, Chicago, Cincinnati, Pittsburgh, Baltimore and Newark.

Airtemp Appointments

Airtemp Division of Chrysler Corp. has made the following appointments of new regional managers and distributors—

Adam J. Pataky, former Dayton branch manager of the Holland Furnace Company, will be Southwestern District Manager with headquarters in St. Louis.

Charles Gregg, former zone manager for Airtemp in Washington, is promoted to the Boston office as New England regional manager.

Arthur M. Suit is named head of the Washington office as regional manager of the South Atlantic district. He was

INSTALL MULTI REFLECTORS

Two Piece
Gloss Steel
Diffuser



Industrial Reflector

for
FACTORY
OFFICE AND
WORK SHOP

IT'S A
GOOD
BUSINESS MOVE!

Multi Reflectors are always in demand because there's always a particular reflector for the job that gives best results in service and appearance. Contractors are always ready for today's demands for modern lighting with Multi. They give them hearty endorsement because they are easy to install, look good, and stay in service for long periods. Multi is the line for more lighting business. A good move in the right direction is to send for our catalog today.

**MULTI ELECTRICAL
MANUFACTURING CO.**

1840 W. 14th St.

Chicago, Ill.



List
Price
\$9.95

**N
E
W**

*an ideal leader for
YOUR 1940 FAN LINE!*

Here's a streamline 10-inch COOL SPOT oscillating fan that through the use of heavily pitched, quiet type fan blades and slow speed induction motor delivers 610 C.F.M. and is unusually efficient and quiet . . . adjustable for oscillating or non-oscillating operation. Its other features mark this fan as dependable quality at the right price. See your jobber now, or write for complete details.

SIGNAL ELECTRIC MFG. CO.
MENOMINEE, MICHIGAN

Offices in all principal cities

SIGNAL

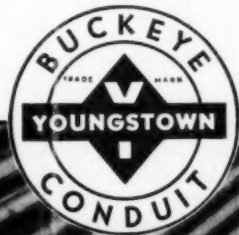
Ever Notice How The Big Jobs Go "BUCKEYE"? 200 Tons On This One!

Your contractors have a lot at stake, you know costs must be kept down to estimates if you're going to come out with a profit. There must be a reason, then, why so many contractors use Buckeye Conduit on the big jobs.

The reason lies in the way Buckeye Conduit is made. Youngstown has the most modern equipment money can buy but -- even more important -- Youngstown also has outstanding men. In the Youngstown mills are men who have spent more than 30 years doing one thing: making conduit. It is their life work; they would consider it a reflection on their ability to pass a single length that was not as perfect as human skill can make it.

Ask your distributor for Youngstown Conduit. Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes.

26-13C



**THE
YOUNGSTOWN
SHEET AND TUBE COMPANY**
Manufacturers of Carbon and Alloy Steels
General Offices - YOUNGSTOWN, OHIO

Buckeye Conduit going into new
Sewage Disposal Plant in Detroit.



Speed Regulator
1101



Ring Type Rheo-
stat 1105



when Fan Controls

TAKE A BEATING!

WARD LEONARD Motor Speed Regulators include everything from the small ring type rheostats for window ventilators to the heaviest industrial blower controls. Well planned arrangements provide circulation of air around resistance elements to dissipate the generated heat. Ward Leonard Speed Regulators will therefore operate continuously, at any speed setting, in the hottest weather without overheating, and if it's automatic control for air conditioning you will be interested in Ward Leonard Multi-Speed Motor Starters.

SEND FOR BULLETINS OF INTEREST

BULLETIN 1101
describes Ward Leonard Speed Regulator, ventilated and enclosed types 1/20 to 1/3 H. P.

BULLETIN 1105
describes Ward Leonard Vitrohm Ring Type Rheostats 1 1/2", 2 1/4", 3" and 4" diameter for 30, 50, 100 and 150 watts.

BULLETIN 4061
describes Multi-Speed Starters.

WARD LEONARD
ELECTRIC COMPANY
28 SOUTH STREET MOUNT VERNON, N. Y.
Electric Controls Since 1892

THERE'S PROFIT IN THE "EFCOLITE" MODERN LINE

Send
for
Catalog
H-40



LOUVERED CONTINUOUS LIGHTING
With Endless Possibilities



5218-5 Lights "Good
Lighting From Any
Angle"

An attractive unit that
has a wide range of
applications from 5-
eighteen watt to 7-
forty watt bulbs, in
18, 24, 36 and 48 inch
lengths.

5218-2 Lights

An industrial unit
that gives ideal light-
ing, employing
Double-Parabolic Re-
flectors and finished
in white vitrified
porcelain to secure
maximum efficiency.
Can be suspended by
chain or rods.

"Certified" FLUORESCENT LIGHTING

OFFERS unlim-
ited oppor-
tunities for Dealers
to cash in on the
demand for this
new "Daylight"
lighting.

It is the ideal light-
ing for FAC-
TORIES, STORES,
OFFICES, and the
choice of archi-
tects for MOD-
ERN HOMES.

EFCOLITE CORPORATION
TRENTON, N. J.

In the News

[FROM PAGE 80]

formerly with Griffith-Consumers Co., Airtemp distributors.

J. George Fischer & Sons, Inc., 900 Lapeer St., Saginaw has been appointed distributors. This company covers a sales area that takes in 23 counties throughout the Thumb district and upper Michigan.

R. L. Spitzley Heating Company, 1200 W. Fort St., Detroit, has been made distributor for this territory.

More Gossip

Boustead Electric Moves

On March 1st, the Boustead Electric Company moved into its new and larger home at 109-111 Washington Avenue, North. They now have an additional 3200 square feet of floor space.

Better Light Film Promotion

The lighting committee of the Electrical League of the Niagara Frontier is developing a Better Light-Better Sight film entitled "Progress of Illumination" which covers proper lighting in the home. It will be released shortly and shown in the theatres in Buffalo and western New York.



INVENTOR J. A. Dumas of the O K Electric and Machine Works, motor repair shop in Brooklyn, N. Y., has a fondness for that great American delicacy, the "hot dog". He likes them so well that in his spare time he decided to do something about their proper preparation. The result—He and Romaine B. Stoker are now the proud possessors of a patent for an all electric "Roller Grill" which keeps the "dogies" in perpetual motion while gently toasting them. And a detachable toaster prepares brown crisp rolls.



It's Good Business

to PUSH AUTOMATIC ELECTRIC PRIVATE TELEPHONE SYSTEMS

INTERCOMS

Available in both desk and wall styles. Equipped with molded plastic handsets. Common talking systems of two to eleven stations.

IDEALFONES

Compact, wall type telephones with molded handsets. Offered with one or five buttons for common talking service up to ten stations.



SERV-U-FONES

Low priced, all metal telephones, in common talking systems of two to ten stations. Conveniently packaged and simple to install.

P-A-X's

Private automatic exchange systems, providing dial service and secret connections, from ten stations up. Telephones in a variety of types.

These systems are designed for private service. They are not intended to be connected with the public telephone system.

because sales of these time- and step-saving telephones represent "extra" business netting you "plus" profits.

because every time you sell an interior telephone system you get a new opportunity to sell wire, batteries, accessories, and in time to come, additional stations and equipment.

because each one of the systems in use reminds the purchaser of the completeness of your service and its faithful performance advertises the dependability of your products.

Automatic Electric makes private interior telephone systems to fit every need. Shown here are four of the many types available. Your local electrical wholesaler will be pleased to supply you with literature and prices. Talk to him.

AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois

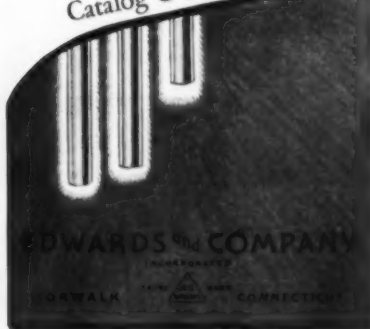
Sales and Service Offices in Principal Cities

In Canada: Canadian Telephones & Supplies, Limited, Toronto



The enchanting melody
of an
EDWARDS DOOR CHIME
appeals to the home owner
of today... but when this
same chime is styled to express
the personality of your cus-
tomer and enrich the beauty
of her home decorations... the
combination is irresistible.

Be sure to show her the
Edwards chime display
at your Electrical Whole-
saler or the complete line
illustrated in Chime
Catalog C-5.



In the News

[FROM PAGE 82]

KW. Versus KVA

Bill Templeman of the Premier Electric Construction Co., Chicago, wondered why he lost a recent industrial job. It involved feeders for some welding equipment, and he found out his price was way high. He discovered that his competitor had figured wire sizes by Code minimum based upon the kw. rating of the equipment.

Bill, who is a mean hand with a slide rule, figured what was going to happen—and it did. With voltage drop and low power factor, the voltage at the equipment, which should have been 220, dropped to 160.



LIGHTING INSTITUTE directors who staged mammoth fluorescent lighting school in Chicago; Carl W. Zersen, manager of the Chicago Lighting Institute and Edwin D. Tillson, technical director of the Chicago Lighting Institute and testing engineer of the Commonwealth Edison Co.

Successful Exhibit

The recent electrical exhibit at the Electrical Convention and Trade Exposition Week in St. Paul was not only highly successful from the promotional standpoint but proved out financially as well. Exhibitors received a 15 per cent refund from the North Central Electrical Manufacturers Club from the earnings of the exposition.

Sports Lighting Job

The Morganstern Electric Company of Pittsburgh will have the distinction of installing the flood-lighting equipment for the brightest lighted sports field in the world.

They have the contract to install at Forbes Field, home of the Pittsburgh Pirates, the flood-lighting system recently purchased by the Pittsburgh Baseball Club.

easily—

swiftly—

"for KEEPS"!

That's the way you can make all your electrical connections... with



SOLDERLESS LUGS

Look for the V-Bottom wire opening—a "first" for ILSCO—the source of "for keeps" grip.

- Look to your Electrical Wholesaler for your electrical needs.

DEPT. SEC

IlSCO Copper Tube & Products, Inc.
5629 Madison Road, Cincinnati, Ohio



No need for this sign
when you have an

**ELECTRICAL BUYERS
REFERENCE**

Containing complete information
on electrical and allied products

Use your copy regularly
to save time and money!

ELECTRICAL CONTRACTING
330 West 42nd Street, New York

for the DANGEROUS HOURS of DARKNESS • SPECIFY

FLOODLIGHTING PROTECTION*



CAK-12, 14, 16 & 20



A-8 & A-10



A-14, 16 & 20



AF & AFA-16 & 20



VHR-18

FLOODLIGHTING IS "NIGHT-TIME INSURANCE"

Industrial floodlighting has long been considered a protective necessity. Today, it assumes even greater significance . . . not alone in the adequate illumination of buildings and industrial yards for night-time production, but also to discourage prowlers, trespassers and vandals and to reduce malicious property damage.

Today the mere installation of lights about a plant—large or small—does not afford complete protection. Instead, Floodlighting calls for an individualized layout that will provide light where it's needed for every eventuality.

Westinghouse, with a complete line of scientifically designed units for every floodlighting need, offers a complete layout and counselling service by skilled engineers through the nearest Westinghouse Distributor or Sales Office. This service is yours for the asking.

If you already have floodlighting on your premises, have it checked for *maximum protection and efficiency*. If you are planning new construction, ask Westinghouse for a layout that will assure complete protection for your property. A Lighting Specialist is available for this service. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

For these points:

- * Industrial Yards
- * Power Substations
- * Walls and Fences
- * Storage Areas
- * Stacks and Water Towers
- * Docks and Piers
- * Ship and Railroad Yards
- * Dams and Bridge Abutments
- * Railroad Spurs
- * Loading Platforms
- * Parking Lots
- * Craneways and Bridges
- * Plant Entrances
- * Construction Areas
- * Factory Police Stations
- * Emergency Uses

Westinghouse

Lighting Equipment

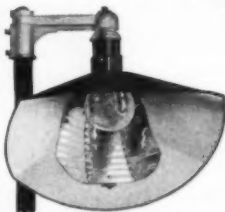
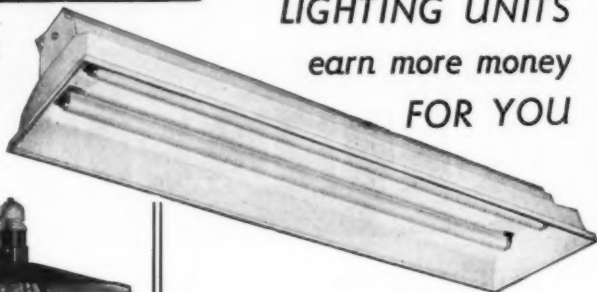




Make those up-to-date
jobs with QUAD
LIGHTING UNITS
earn more money
FOR YOU

RLM

Fluorescent
twin lamp
porce-
lain en-
ameled
unit.



Long Beam Floodlights



RLM Standard Dome



★ QUAD Lighting Unit installations go right to work for Contractors. Simplicity of installation and high lighting efficiency leave more time to take on more jobs—more jobs mean only one thing—more money! QUAD Units are modern—weatherproof and you can always find the right unit for any installation indoor or out. Good looking finished work—no after worries—that's what QUAD Lighting Units are noted for. See your Wholesaler or write us direct for more information.

QUADRANGLE MFG. CO.
32 S. PEORIA ST. CHICAGO, ILL.



[FROM PAGE 84]

More Wiring, More Waffles

"Doc" Smedley, Anaconda adequate wiring missionary, tells of a mighty convincing demonstration of what happens on overloaded wiring. The idea is to hold a waffle party. Because you are going to need a lot of waffles, have everyone bring their own waffle iron. Starting with one waffle iron you don't get enough waffles, so you plug in another waffle iron. Logically you ought to get twice as many waffles, but actually it doesn't work out that way. Maybe you get half again as many more.

That isn't enough, so you plug in a third waffle iron. Do you get more waffles? The chances are you won't get any waffles at all!



"HOUSE WIRING keeps our business going when large construction lags. We are thankful we have always kept in step with this branch of the industry," says Walter W. Whiffen, president of Whiffen Electric Co., White Plains, N. Y. Prompt material deliveries, accurate costs and a specialized crew makes it possible for this company to compete in the residential wiring field.

Sample Sells

If you stopped an Omaha man a year ago and asked him where the best Christmas illumination was, he would tell you to hike up to the 24th and Farnum Street business district. The Sterling Electric Company which lives there, had collected a few hundred dollars, and kicked in heavily themselves and put up a sample of civic Christmas lighting that outshone the central business district.

Sequel—In 1939 come Christmas Ed Grafantine, of Sterling, received a delegation of city fathers upholstered with a liberal check and a commission to light up the central business district. And Omaha is still cheering.

Badger

Synchronous

**ELECTRIC TIME
SWITCHES**



CONTRACTORS LIKE THEM BECAUSE:

they are dependable and easy to install

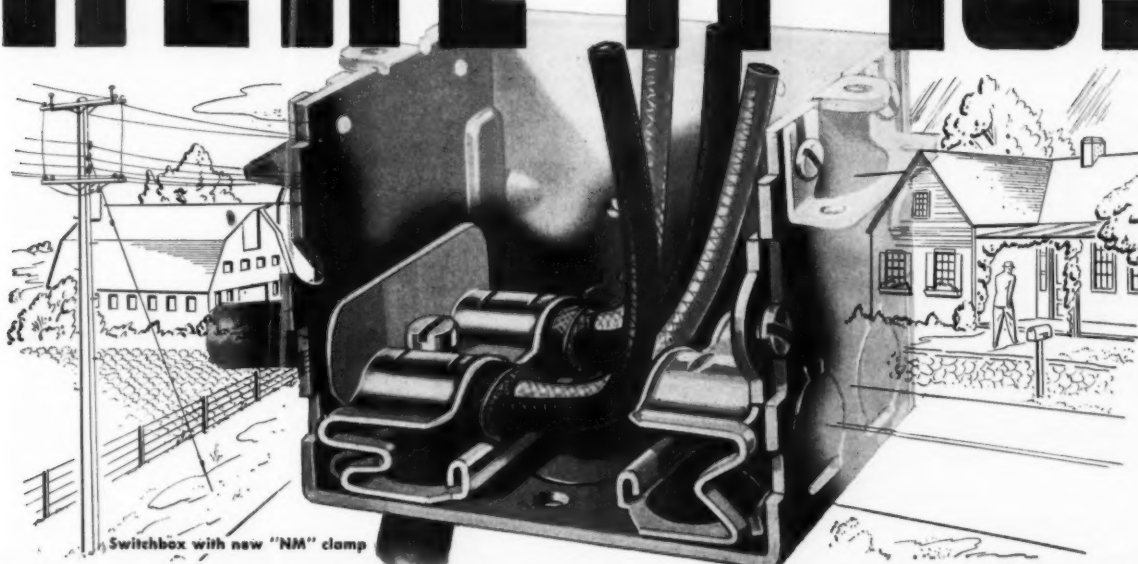
USERS LIKE THEM BECAUSE:

of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET RACINE, WISCONSIN

HERE IT IS!



Switchbox with new "NM" clamp

THE BEST NON-METALLIC CABLE CLAMP YOU EVER SAW



"NM" Clamp

You'll like this new Raco • All-Steel product and the way it solves the non-metallic-cable-clamp problem. It is the satisfactory answer to the needs created by the rapidly increasing use of non-metallic cable and the tendency toward the use of heavier conductors for circuit wiring.

The "NM" clamp permits the cable to enter at side (end) or bottom, or both simultaneously. Because of its construction, this clamp protects the cable from the shearing action of the sharp edges of the knockout. The possibility of injury to the cable is eliminated. It accommodates a wide range of cable sizes, from the full

capacity of the K. O. down to the smallest CNX type. Clamp is held clear of the knockout until you're ready to use it. And the "NM" clamp is available in both switch and outlet boxes.



Outlet box with new "NM" clamp

Standardizing on Raco • All-Steel • Products assures you of products that have been kept up-to-date. They provide many advantages for rural and urban modernization work, as well as on new jobs. Write for a copy of the Raco • All-Steel • Products catalog—there is no obligation.

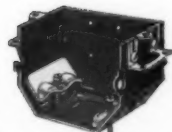
Distributed nationally by:

ALL-STEEL-EQUIP COMPANY

INCORPORATED

604 Griffith Avenue, Aurora, Illinois

Factories: South Bend, Ind.; Aurora, Ill.



RACO • ALL-STEEL BEVELED CORNER SWITCH BOX for all types of non-metallic cables.



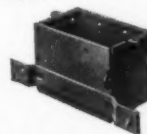
RACO • ALL-STEEL METALLIC CABLE BOX— $3\frac{1}{4}$ " or 4" octagon with non-protruding clamp screws. Box may be installed on flat surface.



RACO • ALL-STEEL BOX for sidewall bracket—2" vertical adjustment. Bridge is threaded for $\frac{1}{4}$ " nipple and equipped with set screw.



RACO • ALL-STEEL 4" SQUARE BOX with mounting bracket. Simplifies the installation of switches and receptacles.



RACO • ALL-STEEL "SIDE-MOUNT" SWITCH BOX. Mounts to side of studing affording a neater wall-board job. Bracket is detachable.



RACO • ALL-STEEL • PRODUCTS

Switch Boxes • Outlet Boxes • Cutout Boxes • Cabinets • Conduit Fittings
Distributors in All Important Centers



The Little Man
Who's Always There
—in Quality,
—in Performance,
—in Value!



TRADE
RATTAN
MARK
MAN



Take a screw driver — twist — nothing else required to make a perfect joint with the **MARR CONNECTOR**. We'll be glad to send you a **SAMPLE — FREE!**



Approved by Underwriters

THE RATTAN MANUFACTURING COMPANY

522 STATE STREET
NEW HAVEN, CONN., U. S. A.
GENERAL SALES AGENTS HATHEWAY AND CO.
229 CHURCH STREET, NEW YORK, N. Y., U. S. A.



**FLUORESCENT
LAMPS**

- ★ Remember, AC-operated fluorescent lamps should have power-factor correction. Otherwise wiring may be overloaded, electric bills excessive.
- ★ AEROVOX capacitors are the answer. Used as initial equipment or for existing installations. Flat units mount flush inside fixture or above it. Three types, taking care of all standard fluorescent lamp types. Ask jobber about them. Or write us direct.
- ★

AEROVOX
NEW BEDFORD, MASS.



[FROM PAGE 84]

Fluorescents Gets Them

When Minneapolis and St. Paul electrical contractors organized a conference on fluorescent lighting as a part of the recent convention week activities in St. Paul, Minnesota, the session was scheduled for one of the small conference rooms. Also, it had to be scheduled for an evening meeting to avoid conflict with other convention activities. The general outlook wasn't so hot.

When the time came, however, the main ball-room and sound amplification facilities had to be used to accommodate a crowd of over 500 who wanted to sit in on the session.



MARKSMAN, W. A. Solliday, owner of the Solliday Electric Shop, Allentown, Pa., is the proud possessor of a private pistol range in the basement of his shop. When he is not aiming at fair prices in his electrical business, he is downstairs indulging in his favorite hobby—blasting the bulls-eye with one of his favorite guns. "W.A." is a camera-hend also and makes good "shots" of his installations. And incidentally, he develops and prints them himself, in his own darkroom.

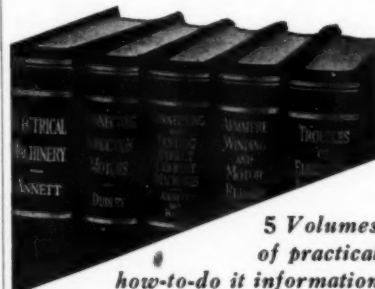
Help Also Meet

Those who think that trade association activities consist of well fed looking gentlemen sitting around smoking large black cigars and fixing prices would get something of a jolt if they looked into the activities of the Central District Chapter of N.I.S.A., organization of electric motor repair shops in Chicago.

A series of educational meetings brings together the salesmen of the member organizations, the accountants and bookkeepers, and the shop foremen. They talk over common sales problems, how to do a better job of bookkeeping and accounting, and better shop methods and personnel relationships.

The cynics will say that you can't get these men to talk about real problems with the boss sitting there listening. They thought of that too, and some of these meetings are open to the employees only, the boss can't get in.

Every phase of electrical maintenance and repair work covered in this **NEW Library**



5 Volumes
of practical
how-to-do it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with hand-book information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

- install all types of motor and generator units;
- locate breaks in armature windings and do a workmanlike job of rewinding;
- know just what is wrong with an electrical machine and take charge of installation and maintenance work;
- make accurate tests of switchboards and apparatus and correctly balance the power with the load;
- handle every sort of wiring job;
- show competence, whether it be in the use of a Stillson wrench or a Wheatstone bridge.

New trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 days' examination Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
330 W. 42nd St., New York, N. Y.

Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you \$1.00 in 10 days, and \$1.00 a month until \$15.00 has been paid. Otherwise I will return the books postpaid.

Signature

Address

City and State

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Position E.C. 4-40
(Books sent on approval in U. S. and Canada only.)

Electrical Contracting, April 1940

CONTRACTORS MAKE MONEY

WIRING HOMES, STORES, OFFICES, FACTORIES THIS **NEW** WAY

with "PLUGMOLD" Multi-Outlet SYSTEMS

No, it doesn't cost LESS to wire for *true* adequacy and convenience with the "Plugmold" Multi-Outlet System. In many cases it costs MORE. But, listen...

... you can give your customer a job so far superior in convenience, in appearance, in adaptability to present and future needs, that there is really no comparison.

... you handle and install a product that makes *maximum* use of your skill... taking you out of the competitive class, netting you a better profit and assuring your customers' satisfaction.

Yes, there are hidden values in "Plugmold" that wide awake Wiremold Contractors are turning into better and *more profitable* jobs. Why not let Wiremold Engineers help you work out a "Plugmold" installation on your next important contract? Just write direct to Hartford.

THE WIREMOLD COMPANY, HARTFORD, CONNECTICUT

Your Business Builder



WIREMOLD

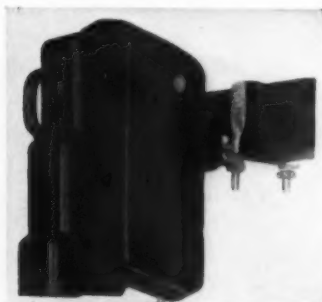
LIGHTING and WIRING EQUIPMENT

LISTER BY VICTORVILLE BY LABORATORIES - INC

EQUIPMENT *News*

Fuse Cutout

A 100-ampere reclosing fuse cutout in 5000-volt and 7500/12,500 Gr Y volt ratings has been developed. Has automatic reclosing, sleet proof design and interchangeability. It functions by automatically connecting a second fuse link in circuit one second after first fuse link blows. When this happens, door of cutout is pushed open at bottom and a red indicator, visible from the ground appears. General Electric Co., Schenectady, N. Y.



G.E. FUSE CUTOUT

Lighting Unit

A new series of single, double and triple industrial type fluorescent lighting units for use with all lamp sizes from 18- to 48-in. Available either unwired or completely wired, ready to hang in position. Furnished with Alzak or Ox-a-lite reflectors of either concentrating or diffusing type, and adjustable to 2 or 3 angle positions. Finish of unit is aluminum. The Wiremold Company, Hartford, Conn.



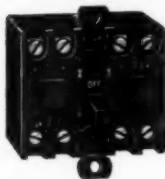
WIREMOLD INDUSTRIAL UNIT



ACME TRANSFORMER

Aircooled Transformers

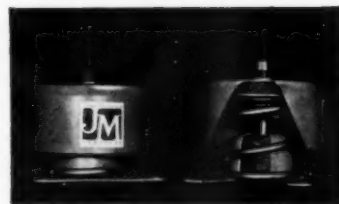
A new line of aircooled power transformers with 15 and 25 kva ratings. Ratings can be supplied in insulated types, with primary voltages of 575, 230/115 or 460/230 and secondary voltages of 230/115. Some of the features are air draft ventilation; specially wound coils, insulated between layers with high dielectric strength insulating materials; cores of thin gauge steel. Especially adapted for industrial application where oil-cooled transformers may effect fire risk. Acme Electric & Mfg. Co., Cleveland, Ohio.



ARROW-HART & HEGEMAN SWITCH

Switch

New "Load Limit" thermal switches for single phase motors to 1½ hp. or polyphase motors to 2 hp. Some of the features are front operated, front wired; thermal overload protection with interchangeable heaters; trip free operation; quick make and break. Manually operated for a.c. or d.c. motor control. Arrow-Hart & Hegeman Electric Co., 103 Hawthorn Street, Hartford, Conn.



JOHNS-MANVILLE ISOLATOR

Vibration Isolator

The J-M controlled spring isolator was designed to control machine vibration and reduce noise. It was developed for use on bases of motors, generators, pumps, ventilating fans. Unit consists of a coil spring and rubber load pad, which supports equipment and isolates vibration, and an adjustable rubber snubber inside base, which controls excessive motion. Built for horizontal, torsional and vertical vibration. Available in two sizes—light duty for loads from 60 to 190 lb. per isolator and heavy duty for loads from 250 to 720 lb. per isolator. Johns-Manville, 22 East 40th Street, New York, N. Y.

Tapes

Three new tapes, each designed for use in splicing insulation of a different type of cable have been developed. No. 330 is for use with super-aging insulations, such as Aquanol, Tempnol, Versatol; No. 351, an oil-base rubber tape, for use in splicing insulation of high-voltage cables; No. 387, a Tellurium compound splicing tape, for use in patching and splicing tough rubber jackets of cables. General Electric Co., Bridgeport, Conn.

Auxiliary Switch

An electrically operated auxiliary switch designed for making and breaking several circuits simultaneously. Provided with any arrangement of make and break contacts up to 10. By means of geared switches and parallel or series arrangement of switch coils, any desired number or combination of circuits can be handled. Two operating arrangements are provided as standard. One type can be tripped from front of panel by rotating handle; the other can be tripped only by operating mechanism behind panel. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE SWITCH

Electrical Contracting, April 1940



HOW THEY GOT A LILY OUT OF BED IN TIME FOR EASTER



2 SCIENTISTS USED standard 150 watt G-E MAZDA lamps in this test. Similar experiments have employed sodium vapor and mercury arc lamps. General Electric research is constantly finding new ways to improve existing lamps, as well as developing new lamps to meet specific problems.



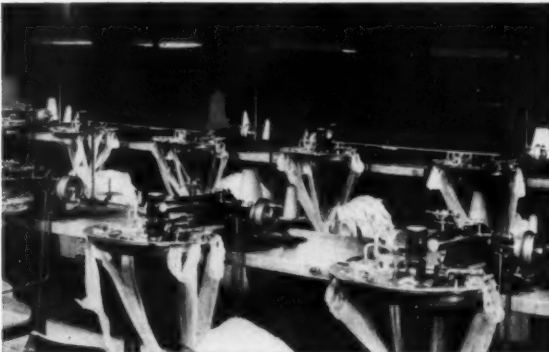
4 THIS GIANT "ELECTRIC EYE" measures light output of G-E bulbs...one of 480 tests and inspections. Sixty years of G-E research and development have increased lamp efficiency as much as 1000%, reduced prices as much as 85%. Today's 100 watt 15c lamp is almost 50% brighter than the same size you paid \$1.10 for in 1921. To get more and more light for your money, year after year, be sure to buy G-E MAZDA lamps.

G-E MAZDA LAMPS GENERAL ELECTRIC

Year by year, better lamps for every purpose



1 IF EASTER LILIES BLOOM TOO LATE, florists lose heavily. To the rescue come scientists, who show how blooming can be advanced two weeks with electric light. At Ohio State University, lily at left was kept at 60° F with no added light daily. Lily at right was given same heat plus four hours extra light daily.



3 THIS TRYON, N.C. MILL gets 100 footcandles of light on the points of its loopers by using G-E MAZDA Daylight Fluorescent lamps in 24" units mounted above each machine. Can you use these lamps in your mills? Ask your G-E lamp man or your local electric service company.

G. E. MAKES 9000 DIFFERENT LAMPS...

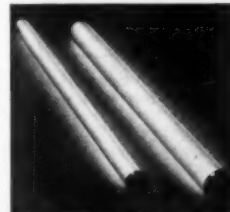
How many can help your business?



LIGHT WHERE YOU NEED IT with G-E MAZDA Projector lamp. Lens, filament and reflector in one all-glass unit. The 150 watt size is now only \$1.40.



INCREASED DEMAND for more light has sold more larger size bulbs, like this 300 watt inside frost G-E MAZDA lamp. It sells for only 55c.



NOW AT NEW LOW PRICES! G-E MAZDA "F" (fluorescent) lamps provide higher levels of lighting, are comfortably cool. 15 watt daylight type, \$1.15.



INDIRECT LIGHT at low cost with G-E Silvered Bowl MAZDA lamps. A coating of mirror silver is sealed on bowl. The 150 watt size costs only 55c.

HIGH LIGHT OUTPUT
REFLECTOR EFFICIENCY
CORRECT DESIGN

★



TWO-LIGHT
RLM
STANDARD

FLUORESCENT LAMP FIXTURES

OAMCO
REFLECTORS

**SUPERIOR
FEATURES:**

- light output is 78%
- angle of cut-off is 17-1/2° from horizontal or 72-1/2° from vertical line—accepted as good lighting practice by RLM
- new tu-lamp auxiliary corrects power factor to 99-100%—reduces flicker to minimum
- new style FS4 starting switch is renewable and mounted in reflector for easy accessibility

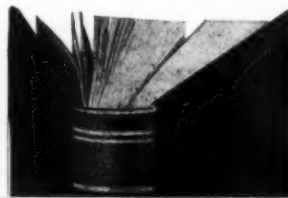
The new OAMCO RLM 2-light 40 watt porcelain enameled fluorescent lamp fixture is designed especially for general illumination of industrial and commercial locations. Particularly applicable when uniform illumination and color correction is desired. 20-foot candles of daylight quality lighting are evenly distributed over working surface. Made in accordance with rigid specifications of RLM Standards Institute and is approved by Electrical Testing Laboratories. Reflector is porcelain enameled gray outside, white inside—reflector ends are closed to shield lamps. Send for descriptive bulletin which gives construction and illumination details.

OVERBAGH & AYRES MFG. CO. 411 S. CLINTON ST. CHICAGO, ILLINOIS

How to wire for light and power . . .

Step-by-step methods fully and simply
explained in this new book

Just Out H. P. Richter's



PRACTICAL ELECTRICAL WIRING

Residential, Farm, and Industrial

500 pages, 5 1/2 x 8
illustrated
\$3.00

Covers:

I. Underwriters and codes; electrical principles and measurements; basic devices and circuits; wire, sizes and selection; connections and joints; residential and farm motors; etc.

II. Planning an installation; specific outlets; switches and other devices; old work; farm wiring; isolated lighting plants; wiring apartment houses; etc.

III. Planning non-residential installations; non-residential lighting; miscellaneous problems; wiring for motors; wiring schools, offices, stores, churches; etc.

HERE is a complete course of instruction for those who want to learn how to do electrical wiring. Begins with very first elements and takes the reader by easy steps, plain instructions and methods, to the completion of typical wiring jobs in accordance with official requirements. Employs simple language; confines mathematics and theory to the minimum necessary for understanding of the work; covers medium voltage jobs of the types that are most in demand.

10 DAYS' EXAMINATION—SEND THIS COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Richter's Practical Electrical Wiring for 10 days' examination on approval. In 10 days I will send \$3.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

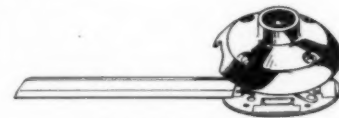
Name
Address
City and State
Position
Company E.C. 4-40
(Books sent on approval in U. S. and Canada only.)

EQUIPMENT *News*

[FROM PAGE 90]

Floor Outlet Fitting

A new brass utility box fitting, No. 1542 B, for use with Wiremold "Pancake" overfloor raceway wiring system. Designed to take any standard 1-in. stem type floor outlets for power and light or telephone circuits. Utility box is of heavy construction giving a sturdy base for fittings and designed for heavy duty service. Increases utility and flexibility of over-floor systems for a wide range of office, commercial building and industrial plant wiring. The Wiremold Company, Hartford, Conn.



WIREMOLD UTILITY BOX FITTING

Electric House Number

An illuminated house number, called the Sentinel, shows address plainly, both night and day. Attach to any convenient location, run specially insulated wire along moulding crack to front doorbell push button and attach to two bell circuit terminals. Available in three styles—Old English made of hammered aluminum; Moderne of aluminite and Colonial of brass. Spencer Studios, 224 North 13th Street, Philadelphia, Pa.



SPENCER STUDIOS SENTINEL

Insulation

A new "Varslot" insulation made from 100 per cent rag paper, combined with black bias varnished cambric, is available in either sheets, continuous rolls, tape or strip form. It is tough, has improved bearing strength; will not buckle when placed in slot; dielectric strength after bending is same as in original form; is workable and can be cut, slit or punched and can be stored without deteriorating. New Jersey Wood Finishing Co., Inc., Woodbridge, N. J.



"It took 225 man-hours to install this system . . . it has required no service . . . any qualified contractor can install Teletalk."

Henry Dormitzer, Electrical Contractor who installed Teletalk System at Carter, Rice & Company, Boston.

IT'S always good business to heed the voice of experience, particularly where a contractor comes through with a truly successful job—one upon which you can build—one that points the way in very definite fashion to PROFITS.

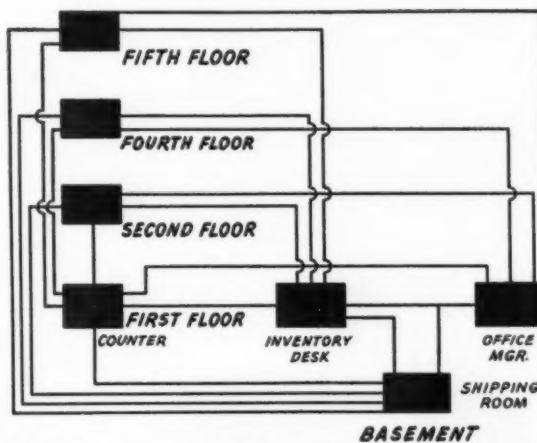
The contractor who has such a message this time is Mr. Henry Dormitzer and he writes: "Carter, Rice & Company had another system for about a year which gave them a great deal of trouble. They installed the Teletalk system over a year ago and have not had to go back for any repairs; it has been positively trouble-free since installation. It took about 225 man-hours to install the system. Any qualified electrical contractor can install this system."

This is but one example of what you can do with Teletalk—and Teletalk does not limit you but does allow you to sell installations from the smallest requirement to unusually large ones—the profit is there (1) in the sale of Teletalk (2) in the necessary equipment for installation (3) in the labor.

Make a step in the direction of this kind of profit and write for literature and the name of the nearest Teletalk distributor.

Licensed by Electrical Research Products, Inc., under U. S. Patents of American Telephone and Telegraph Company and Western Electric Company, Incorporated

WEBSTER ELECTRIC COMPANY, Racine, Wisconsin, U. S. A.
Established 1909. Export Department: 100 Varick St., New York City
Cable Address: "ARLAB", New York City



(above) Diagram of installation at Carter, Rice & Company, Boston, Mass.

(below) Teletalk at counter of Sales Office, first floor.



WEBSTER ELECTRIC
Teletalk Amplified
REG. U. S. PAT. OFFICE
Intercommunication

Webster Electric

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF TELETALK INTERCOMMUNICATION AND PAGING SYSTEMS • POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT • RADIO PHONOGRAPH PICKUPS • IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNERS

McGILL LAMP CHANGER



Eliminate the hazards of falling off step-ladders, chairs or boxes while removing or inserting lamp-bulbs.

Popular for years with firms interested in cutting down industrial accident losses, the NEW model McGill Lamp-Changer has even further safe-guards embodied in its construction. Now, rubber-covered fingers with a coil spring around the tips, make for much quicker and easier removal or insertion of the bulb. The automatic locking device, between each pole-section, assures rigidity in every length of pole, up to the 30-foot maximum. The flexible joint, with cord attached, provides for easy operation at any angle.

Insulated for

Safety



The McGill Improved Lamp-Changer is insulated for safety. One section, including a 1 3/4-inch insert of insulating material prevents any shock or injury to the user, should the Lamp-Changer come in contact with exposed live wires. Regardless of the length pole you order for your Lamp-Changer, the insulated section is included.

Why run risks any longer in your plant? Send now for a McGill Lamp-Changer to protect life and save costly accidents in your organization.

(Listed by Underwriters' Laboratories)

McGILL Products Can Be Secured from Your Electrical Wholesaler

McGILL MANUFACTURING CO.
Box No. 670 VALPARAISO, IND.

McGILL

EQUIPMENT News

[FROM PAGE 92]

Lighting Fixture

A new and improved indirect Standlite for gasoline stations. It is designed for areas which require evenly diffused light, free from glare and shadows. Has an inner reflector and vertical arm supports. Mounted from 10- to 12-ft. high, the low mounting facilitates installation and servicing. Unit is entirely weatherproof. Goodrich Electric Company, 2900 N. Oakley Ave., Chicago, Ill.



GOODRICH STANDLITE

Switch

The Shawmut Type B motor overload switch is a manually operated auxiliary circuit breaker, combining off-and-on switching with thermal over-load protection. It is designed for use with fractional horse power motors. Can be obtained either in open-type or enclosed-type. Mounting bracket and operating handle fit standard boxes and cover plates, allowing a variety of flush and surface mounting applications. The Chase-Shawmut Co., Newburyport, Mass.



CHASE-SHAWMUT SWITCH



WOLVERINE SOLDERING LUGS

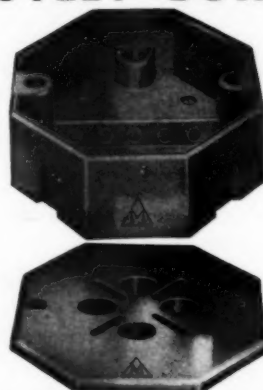
- High-Conductivity
- Square-End
- Uniform Dimensions

BUY FROM YOUR JOBBER



WOLVERINE TUBE CO.
DETROIT, MICHIGAN

Profit by USING ILLINOIS Dependable Porcelain OUTLET BOXES



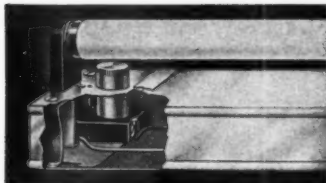
* Glazed and enameled style conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

Lamp Holder Fitting

Fitting No. 3020A accommodates new type fluorescent lamp holders having FS-2 or FS-4 starting switch mounted in base of lamp holder. It snaps into standard Wiremold No. 3000 fluorescent lighting channel, providing a support for complete lamp holder and starter switch unit at one end of each lamp assembly. Reflectors have knockouts to accommodate this switch. It is designed so that lamp holder only can be used when desired. The Wiremold Company, Hartford, Conn.



WIREMOLD FITTING

Resistor Cable

A new Deltabeston resistor cable has been designed for connecting banks of resistors where moisture and heat are prevalent. Insulation is composed of a layer of Flamenol tape next to tinned copper conductor, then a layer of felted impregnated asbestos, and an overall asbestos braid with a heat- and moisture-resisting finish. Cable with solid conductor is available in sizes from No. 14 to 0000, and with stranded conductor from No. 14 to 1,000,000 C.M. General Electric Co., Bridgeport, Conn.



G.E. RESISTOR CABLE

Relay

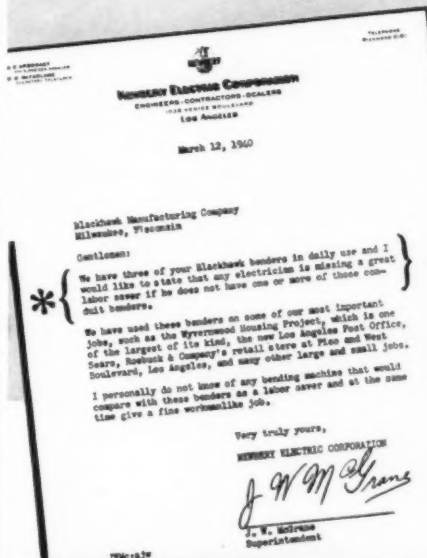
A light-duty closing relay, known as Type HKA pump-free control relay, is for oil circuit breakers equipped with "cut-off" switches. It consists of an operating and auxiliary element. One set of contacts opens main-element coil circuit and de-energizes solenoid closing coil. A second set closes to seal in auxiliary element around cut-off switch. Contact pressures greater than normal are used on auxiliary. A permanent blow-out magnet of Alnico is provided. General Electric Co., Schenectady, N. Y.



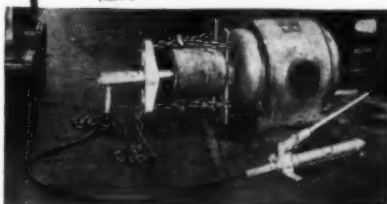
G.E. RELAY

Electrical Contracting, April 1940

"WE HAVE THREE Blackhawk Benders IN DAILY USE"*



New Super-Range
Bender. Handles 7
sizes, 1 1/4" to 4".



EXTRA UTILITY—The dependable Porto-Power hydraulic units, furnished in Blackhawk Benders, also serve as special jacks and with attachments for wheel pulling, machinery lifting and 1001 other bend, press, push, pull, clamp, spread and lift jobs.

Porto-Power Hydraulic Pipe Benders take the fuss and cuss out of bending. Light-weight — speedy — few parts — portable — low in cost — accurate — eliminate jack-knifing. Can be rolled or carried to job — easily positioned and operated by one man. Powerful, all-directional hydraulic ram, remote control pump, and exclusive attachments really make bending practical and profitable. First big job will more than pay for Porto-Power. Send coupon now for prices and complete information.

A Product of **BLACKHAWK MFG. CO.**
Department P2140 Milwaukee, Wis.

BLACKHAWK

WORLD'S LARGEST MANUFACTURER OF HYDRAULIC JACKS

MAIL COUPON NOW
BLACKHAWK MFG. COMPANY
Dept. P2140, Milwaukee, Wis.
Send Full Information on your
Pipe Benders.

Name.....

Company.....

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New Improved
Bender for popular
1" to 2" range.



HOUSING PROJECT CONTRACTORS

On those Federal Housing Projects let us help you meet the specifications for:

TIME SWITCHES TIME CONTROLS

Some of the units now being specified are standard stock models in the Automatic line. Others are somewhat "special" and as yet are supplied only by Automatic.

Whatever the specifications, write to Automatic for Time Switches of:

One, Two, and Three Poles
One, Two, and Three Circuits

Intermittent and Interval
Timing.



Automatic Electric Mfg. Co.
Mankato, Minnesota

SPEED UP YOUR PROFITS

with **IDEAL**



1. "Wire-Nuts"
Save on materials—no solder, no tape, no blow torch or fuel. Get a quick O.K. from the inspector or owner. No trouble, no bother. Better electrically—stronger mechanically. A size for every common wiring joint.
2. "E-Z" Wire Strippers
Neatly, easily strip toughest insulation without nicking or cutting strands. Strip solid or stranded wires from No. 30 gauge to No. 6.
3. Cable Ripper and Wire Gauge
Cleanly rips non-metallic sheathed duplex or lead covered cable. Case-hardened cutting point gives long service.
4. Joint Boring Machine
Bores holes at any angle. Operates from floor—eliminates climbing up and down ladder, dangerous reaching, back-breaking effort. Quickly adjustable for overhead work up to 11 feet.
5. Fuse Clip Clamps
Cut down resistance between clips and fuses, insuring 100% contact. Insulated skirt protects fingers from live parts. Seven sizes for gripping wide or narrow Ferrule or Knife Type Clips.
6. Fish Tape, Reels and Pullers
No expensive tape breakage—no live contacts. Cost and trouble of fishing reduced to a minimum. Available in 7 sizes. Junior Size \$2.50 with 50 ft. of tape.
7. Test-Lite and Fuse Puller
Handy pocket size combination tool tests live circuits and pulls fuses.
8. Fuse Holders
Protect over-fused circuits. All sizes available.
9. Fuse Pullers
Eliminate danger of pulling and replacing cartridge fuses by hand. Made of laminated fibre in 4 sizes.

IDEAL SOLD THROUGH JOBBERS

General Products Division
IDEAL COMMUTATOR DRESSER CO.
1041 Park Avenue Sycamore, Illinois

EQUIPMENT *News*

[FROM PAGE 95]

Range Cord

A new three-wire all-rubber range Unicord for connecting console-type ranges. It is available with two No. 8 and one No. 10 conductors or with two No. 6 and one No. 8 conductors. It is possible to connect electric ranges having terminal blocks near the floor line to outlets with single smooth bend in conductors. It permits the range to be pushed closer against the wall. General Electric Co., Bridgeport, Conn.



G.E. RANGE UNICORD

Connector

A new ground connector called Groundem, Type GA, has been developed. It is for joining ground lead to loading and unloading pipes of oil storage tanks. Connector can be taken apart and installed over side of pipe. Copper alloy body and Everdur bolts, nuts and lock washers provide a strong, corrosion resistant assembly. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.



BURNDY CONNECTOR

Appliance Wires

Two new Deltaglass 300-volt, special purpose appliance wires, insulated with glass fiber yarn have been developed. One is a lead wire recommended for small motor leads, electrical appliances, or control circuits. The other is Deltaglass waffle iron hinge wire recommended for flexible hinges. Lead wire is insulated with saturated felted asbestos and varnished glass yarn braid overall. It is resistant to abrasion and moisture and available in sizes No. 18 to No. 8 incl., with either solid or stranded conductor. Hinge wire is available in size No. 18 only. It is small in diameter, flexible and abrasion-resistant. General Electric Company, Bridgeport, Conn.

MINERALLAC HANGER



Conduit $\frac{3}{8}$ "— $2\frac{1}{2}$ "

Cable to $2\frac{1}{8}$ " (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing
to $1\frac{1}{4}$ " conduit.

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HERWIG

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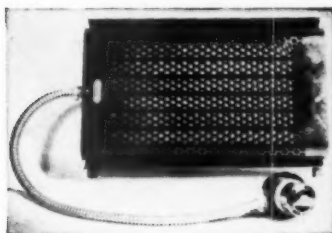
A FIXTURE FOR EVERY OUTDOOR PURPOSE

Send for our
CATALOGUE NO. 40
with NEW SUPPLEMENT
and REVISED PRICE LIST
200 Illustrations

The
Herwig Company
MANUFACTURERS
Established 1908
1753-59 Sedgwick Street
Chicago, Illinois, U. S. A.

Air Heater

A new line of wall and floor mounted air heaters, designed for use in crane cabs, truck houses, valve houses, locomotive cabs, scale rooms and garages. For use with either three-heat hand switch or Type AA thermostat. Wall mounted type range from 25½- to 31½-inches in length and from 10½- to 16½-inches high. Have a rating of 1000 to 4500 watts and operate on 115-, 230- or 440-volts. Westinghouse Electric & Manufacturing Company, Mansfield, Ohio.



WESTINGHOUSE AIR HEATER

Transfer Switch

An automatic transfer switch, spring gravity drop-out type, for automatically connecting a lighting or power load to an emergency source in case of failure. Available in one, two, three or four pole construction, for a.c. to a.c., a.c. to d.c., d.c. to d.c., or d.c. to a.c. Capacities range from 30 to 300 amperes. Switch will transfer when voltage of circuit drops to 70% or less and will restore load to normal source when voltage reaches 90%. Available for standard voltages 110 to 120 or 208 to 240 volts, 25, 50 or 60 cycles, 115 or 230 volts d.c. Special switches for other voltages to 250 maximum. Can be mounted in any position. Zenith Electric Co., 845 South Wabash Ave., Chicago, Ill.



ZENITH TRANSFER SWITCH

Use G-E FIBERDUCT FOR UNDERFLOOR RACEWAY SYSTEMS IN OLD AND NEW BUILDINGS



G-E Fiberduct
in Slab
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in Monolithic
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in Building
Modernization

G-E FIBERDUCT makes wiring layouts flexible. Outlets can be installed anywhere along the system at any time during the life of the building. It can be used to advantage in commercial, institutional or industrial buildings.

Moreover, G-E Fiberduct is economical. It can be installed easily and quickly. It makes expensive rewiring unnecessary. G-E Fiberduct is composed of impregnated fiber which successfully resists every known type of corrosion encountered in actual service. Your customers are sure to be pleased with it.

For further information about G-E Fiberduct and the ways in which it can be installed see the nearest G-E Merchandise Distributor or mail the coupon below for a G-E Fiberduct combined catalog and manual.

General Electric Company
Section C-0124
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me the G-E Fiberduct combined catalog and manual.

Name
Address
City State

GENERAL  ELECTRIC



Hundreds of electrical contractors and industrial electrical men say "B. R.* HELPS ME BUY"

"I use the Electrical Buyers Reference three or four times a week, and it is one of the greatest conveniences I have."

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"This book is used almost daily and without it we would, on many occasions, be inconvenienced a great deal."

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"The writer finds this catalogue of information very essential in locating the place and the company to make purchases."

—Indianapolis, Ind.

"This reference book is very useful in a maintenance organization. There are hundreds of different kinds of electrical and mechanical equipment being dealt with daily. It saves us considerable time in making it possible for us to quickly locate sources of supplies."

—Library, Pa.

"Just glanced through it and saw a pair of B.X. cutting pliers I have tried to get unsuccessfully for the last five years."

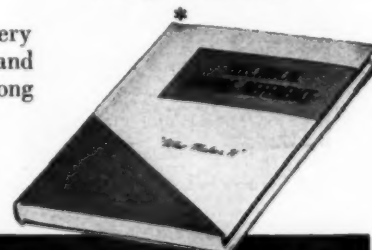
—West New York, N. J.

"I want you to know that I very much appreciate this reference and hardly see how I could get along without it."

—Tama, Iowa

BE SURE YOU MAKE as effective use of your copy of Electrical Buyers Reference as other electrical men are doing. You, too, will find it saves time and money.

It cuts out all guesswork as to where to look to find the products you want in a hurry. No juggling and thumbing through dozens of catalogs. In one handy volume you have data on thousands of products made by hundreds of manufacturers . . . instantly, accurately.



ELECTRICAL CONTRACTING EDITION

Electrical **BUYERS REFERENCE** •

330 WEST 42nd ST., NEW YORK
A Unit of the McGraw-Hill Reference Service

Instruments

A series of new Model 414 "Master Multitester" instruments has been developed. Have a wide range of voltage, current and resistance measurements, and five direct-reading capacity ranges permitting readings from .0001 to 300 mfd. Other features are 4½; 7- and 9-inch meters; styles for bench, counter and rack mounting; cases which permit mounting additional instruments; ohmmeter shorting button; built-in battery and line-power supply for resistance measurements; replaceable instrument fuse in meter circuit and double fused power line. Radio City Products Co., Inc., 88 Park Place, New York, N. Y.



RADIO CITY INSTRUMENT

Relay

A new photoelectric relay, known as Type RQ Photo-Troller, is for counting, sorting, weighing, measuring and signaling. It has two normally open and two closed contacts, each rated at 10 amperes on 116-volt, a.c. circuits. Operates on a change of 40 foot-candles, if not more than 15 foot-candles of extraneous light is present. Unit may be wall or bench mounted with open wiring, or with concealed or exposed conduit. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE PHOTOELECTRIC RELAY

Electrical Contracting, April 1940

NEW LOW PRICES!

for

Set Screw "E. M. T." Fittings

Effective Now



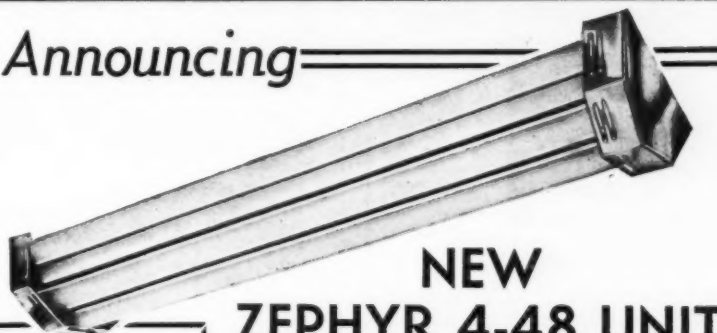
"E.M.T." CONNECTORS			
No.	Size	Std. Pkg.	Cost per 100
402	1/2"	250	\$ 5.00
403	3/4"	125	7.00
404	1"	100	12.00
"E.M.T." COUPLINGS			
452	1/2"	250	\$ 5.00
453	3/4"	125	7.00
454	1"	100	12.00

New, greater economy! Now you can save fully 20% on first cost alone! And with this saving, an easier, speedier, more secure and more rigid installation.

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Announcing

**NEW
ZEPHYR 4-48 UNIT****ZEPHYR 4-48**

Sold with lamp holders, starter sockets, lead wire and plug. Ends are removable. Aluminum finish. 48" overall. Full specifications and prices on request.

Here is an all-purpose, all-direction fluorescent unit, designed to take care of high level lighting requirements. With the Zephyr Unit it is possible to light the ceiling—and at the same time spread light to the sides and directly down. The Zephyr unit uses four 40 Watt Lamps with two Tulamp ballasts. You can sell and install this unit in offices, stores, hotels, restaurants, schools, theaters, etc.—it has a wide variety of applications. Write for literature and price list.

Approved by Underwriters

REFLECTORS INC.

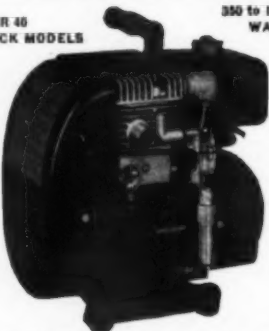
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PHILADELPHIA, PA.

ONAN ELECTRIC PLANTS

OVER 40
STOCK MODELS

350 to 10000
WATTS



ONAN ELECTRIC PLANTS satisfy both Owner and Dealer. Thousands of these **DEPENDABLE PLANTS** are operating **ALL OVER THE WORLD**. ONAN PLANTS GO EVERYWHERE. **COMPACT, HIGH QUALITY**, because they are built by one Organisation specializing in their manufacture for over 14 years. They have proven their **ECONOMY** and **VALUE** to users and a **MONEY MAKER** to dealers.

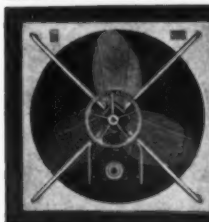
Used in Homes, Farms, Schools, Churches, Theatres, Resorts, Radio Stations. Installed in Boats, Trucks, Trailers, even Airplanes. Supply **LIGHT** and **POWER** to operate Radio Transmitters, Heaters, Motors, Electric Tools. Serve as **EMERGENCY POWER** when Power Company lines fail.

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Models from 350 to 10,000 Watts, A.C. and D.C. or Combined Voltage types ready for shipment and immediate operation.

Climb on our bandwagon. **SELL ONAN ELECTRIC PLANTS**—they sell other electrical goods for you. Write now for prices and discounts.

D. W. ONAN & SONS

791 Royalston Ave., Minneapolis, Minn.



COOLVENT ATTIC FAN

All New—1940
Design—for **LOW
COST** Summer
Comfort - Cooling
of Homes!

ARE YOU PREPARED TO CASH-IN?

The long demand for this type of hot weather ventilation is here! Home builders and owners look to you to supply this need!

INSTALL COOLVENT, the hushed quality fan! System can be furnished complete with suction chamber and ceiling grille if desired! Certified Ratings assure years of safe, trouble-free service! Write—Get Bulletin 40.

AUTOVENT FAN & BLOWER CO.

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CLIPPER MANUFACTURING CO.
Kingston, N. Y.

Please send information on the Electrician's Guide and CLIPPER outlet box supports.

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Address.....

City.....

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* See 1939-1940 Buyers' Reference number of Electrical Contracting for additional information on these companies and their products.

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Solderless Terminal LUGS
and **CONNECTORS**

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INCORPORATED, NEWARK, N. J.

This New K & H Catalog

Is Just Coming
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Illustrating

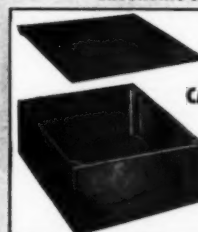
K & H Solderless Terminal LUGS and CONNECTORS

A Request will bring your COPY

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CONDUIT FITTINGS **GEE VEE** CAPS FITTINGS GROUNDING DEVICES



NEW Gee-Vee CAST IRON BOXES

Flanged, Un-
flanged and
Weatherproof
types that simpli-
fy installation
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Write For Full Information

THE GILLETTE-VIBBER CO.
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TEST-O-LITE

Tests Everything Electrical
From 100 to 550 Volts

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C. Only Test-O-Lite, original Neon Tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also. List \$1.50 at leading jobbers.



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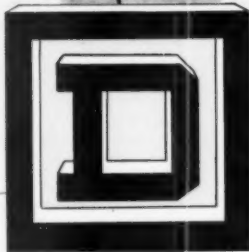
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TYPE "MO" MULTI-BREAKER

• List Price \$240 •

There are several reasons why the Type MO Multi-breaker is a "natural" for water heater installations.

This double-pole circuit breaker is extremely low in price. The installation costs less than replacing the service entrance switch with one of greater capacity. Even in new homes where separate metering for water heaters is required, the double-pole Type MO Multi-breaker is just the thing for the water heater circuit. In new installations using a single meter, the water heater circuit should, of course, be included in the Multi-breaker service center.

All Multi-breakers afford the modern convenience and protection which your customers are quick to appreciate. Standardize on Multi-breakers for your water heater installations. If you haven't the complete story, write for Bulletin CA-543.

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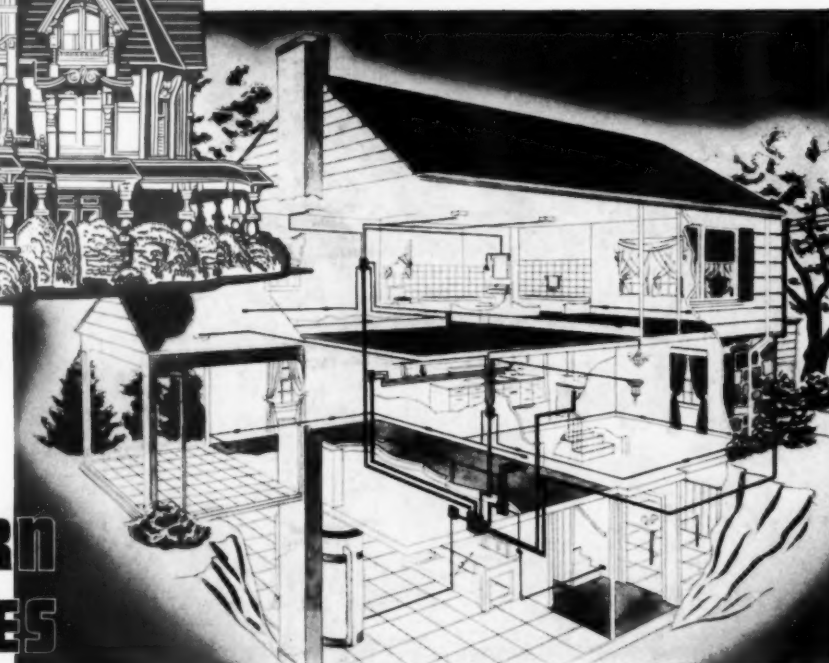
Water heater photos through courtesy
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*Wiring was simpler
years ago*

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YOUR house wiring customers will benefit, and so will you, if you sell and install adequate wiring. Skimpy wiring was all right in the early 1900's when electricity was only used for lighting. But today people want to use the many electrical home appliances that are available.

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G-E Wiring Materials for use in installing G-E Home Wiring include: G-E White Rigid Conduit, Service Entrance Cable, BX, BraidX, Wire and Cable and Wiring Devices including two modern switch lines—a silent sphinx Mercury Switch and a standard switch completely insulated with Textolite. These materials are all of high quality, are designed to be used together and will give long dependable service.

For Further Information

For further information about the G-E Home Wiring or G-E Wiring Materials see the nearest G-E Merchandise Distributor or mail the coupon at right for a Bulletin on G-E Home Wiring and on G-E Materials.



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